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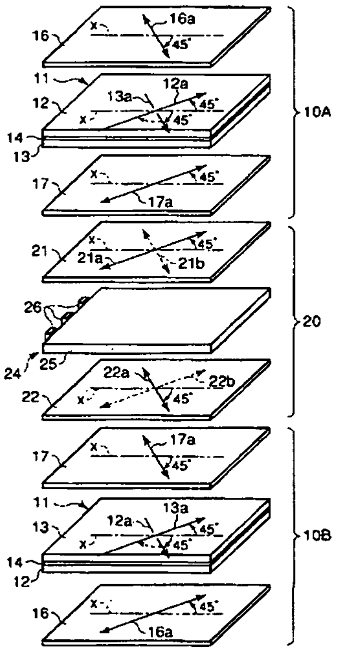
(54) 【発明の名称】表示装置

(57) 【要約】

【課題】一方と他方のいずれの面を表示面とするときも、充分な明るさの反射表示を行なうことができる両面表示型の表示装置を提供する。

【解決手段】表示の観察側である前側から入射した光の透過と遮断を制御する第１と第２の表示素子１０Ａ，１０Ｂを、それぞれの後面を互いに対向させて逆向きに配置し、その間に、入射光の互いに異なる２つの偏光成分のうち、一方の偏光成分を反射し、他方の偏光成分を透過させる一対の偏光分離素子２１，２２を有し、その一方の偏光分離素子２１を透過した偏光成分の光を他方の偏光分離素子２２により反射し、前記他方の偏光分離素子２２を透過した偏光成分の光を前記一方の反射偏光素子２１により反射する反射手段２０を配置した。

【選択図】　図１



【特許請求の範囲】

【請求項１】

表示の観察側とは反対側の面である後面を互いに対向させて逆向きに配置され、それぞれが、表示の観察側である前側から入射した光の透過と遮断を制御する第１と第２の表示素子と、

入射光の互いに異なる２つの偏光成分のうち、一方の偏光成分を反射し、他方の偏光成分を透過させる一対の偏光分離素子を有し、前記第１と第２の表示素子の間に、前記一対の偏光分離素子の一方を前記第１の表示素子の後面に対向させ、他方を前記第２の表示素子の後面に対向させて配置され、前記一方の偏光分離素子を透過した偏光成分の光を他方の偏光分離素子により反射し、前記他方の偏光分離素子を透過した偏光成分の光を前記一方の反射偏光素子により反射する反射手段と、

を備えたことを特徴とする表示装置。

【請求項２】

反射手段の一対の偏光分離素子はそれぞれ、互いに直交する方向に透過軸と反射軸とをもち、入射光の互いに直交する２つの直線偏光成分のうち、前記反射軸に平行な振動面をもった一方の直線偏光成分を反射し、前記透過軸に平行な振動面をもった他方の直線偏光成分を透過させる反射偏光素子であることを特徴とする請求項１に記載の表示装置。

【請求項３】

一対の反射偏光素子は、それぞれの透過軸を実質的に互いに交差させて配置されていることを特徴とする請求項２に記載の表示装置。

【請求項４】

反射手段は、一対の反射偏光素子の間に配置され、透過光の偏光状態を変化させる位相差板をさらに備えていることを特徴とする請求項２に記載の表示装置。

【請求項５】

第１と第２の表示素子は、表示の観察側である前側の基板と、この前側基板に対向する後側基板との間に、印加される電界に応じて透過光の偏光状態を制御する液晶層が設けられた液晶セルを挟んでその前後に、互いに直交する方向に透過軸と吸収軸とをもち、入射光の互いに直交する２つの直線偏光成分のうち、前記吸収軸に平行な振動面をもった一方の偏光成分を吸収し、前記透過軸に平行な振動面をもった他方の偏光成分を透過させる一対の吸収偏光板が配置された液晶表示素子であり、

反射手段の一対の反射偏光素子のうち、第１の液晶表示素子側の反射偏光素子が、その透過軸を前記第１の液晶表示素子の後側の吸収偏光板の透過軸と実質的に平行にして配置され、第２の液晶表示素子側の反射偏光素子が、その透過軸を前記第２の液晶表示素子の後側の吸収偏光板の透過軸と実質的に平行にして配置されていることを特徴とする請求項３に記載の表示装置。

【請求項６】

反射手段の一対の偏光分離素子はそれぞれ、入射光の右回りと左回りの２つの円偏光成分のうち、一方の円偏光成分を反射し、他方の円偏光成分を透過させる円偏光分離層と、前記円偏光分離層の一方の面側に配置され、前記円偏光分離層に対向する面とは反対面から入射した直線偏光を円偏光にして前記円偏光分離層に入射させ、前記円偏光分離層から出射した円偏光を直線偏光にして前記反対面から出射する位相差板とからなっており、これらの偏光分離素子が、それぞれの前記円偏光分離層を互いに向き合わせて配置されていることを特徴とする請求項１に記載の表示装置。

【請求項７】

反射手段は、一対の偏光分離素子の間に配置され、一方と他方の面から入射した光をそれぞれ透過させ、端面からの入射光を前記一方と他方の少なくとも一方の面から出射する導光板と、この導光板の前記端面に対向させて設けられた発光素子とからなる面光源をさらに備えていることを特徴とする請求項１～６のいずれかに記載の表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】
この発明は、両面において反射表示を行なう表示装置に関する。

【０００２】
【従来の技術】
最近、機器本体に対して開閉可能な蓋を有する携帯電話機や携帯端末機等の電子機器として、その蓋を開いた状態でも、閉じた状態でも、情報を表示できるように、前記蓋の内面（蓋を閉じたときに機器本体に対向する面）と、外面とに、それぞれ表示部を設けたものが見られるようになってきている。

【０００３】
この種の電子機器には、表示の観察側である前側から入射した光の透過と遮断を制御する第１と第２の２つの表示素子を、それぞれの後面（表示の観察側とは反対側の面）を互いに対向させて逆向きに配置し、これらの表示素子の間に、バックライトと呼ばれる面光源を配置した両面表示型の表示装置が用いられている（特許文献１、２参照）。

【０００４】
この両面表示型表示装置は、両面の表示をそれぞれ、前記面光源からの光を利用する透過表示としたものであるが、前記２つの表示素子の間に反射板を配置することにより、両面の表示をそれぞれ、外部環境の光である外光を利用する反射表示とすることも可能である。

【０００５】
前記両面表示型表示装置の前記２つの表示素子には、一般に、表示の観察側である前側の基板と、この前側基板に対向する後側基板との間に、印加される電界に応じて透過光の偏光状態を制御する液晶層が設けられた液晶セルを挟んでその前後に、互いに直交する方向に透過軸と吸収軸とをもち、入射光の互いに直交する２つの直線偏光成分のうち、前記吸収軸に平行な振動面をもった一方の偏光成分を吸収し、前記透過軸に平行な振動面をもった他方の偏光成分を透過させる一対の吸収偏光板が配置された液晶表示素子が用いらている。

【０００６】
なお、液晶表示素子には、その後側の偏光板を、互いに直交する２つの偏光成分のうち、一方の偏光成分を透過させ、他方の偏光成分を散乱させて反射または透過させる散乱偏光板としたものもあり、この液晶表示素子は、その後側に光吸収層または反射板を配置して反射表示を行なうようにするか、あるいは、前記散乱偏光板の後側にさらに面光源を配置して反射表示と透過表示との両方の表示を行なうようにした片面表示型の表示装置に利用されている（特許文献３参照）。

【０００７】
【特許文献１】
特開平１０－９０６７８号公報

【０００８】
【特許文献２】
特開２００１－２９０４４５号公報

【０００９】
【特許文献３】
特開２０００－７５２８４号公報

【００１０】
【発明が解決しようとする課題】
しかし、上述したように２つの表示素子の間に反射板を配置して外光を利用する反射表示を行なうようにした両面表示型表示装置は、その一方と他方のいずれの面を表示面とするときも、その表示面の前側から入射して前記表示面側の表示素子を透過した光が、金属膜からなる反射板により反射される際にその一部の光を前記反射板により吸収されるため、両方の面の表示が暗いという問題をもっている。

【００１１】

この発明は、一方と他方のいずれの面を表示面とするときも、充分な明るさの反射表示を行なうことができる両面表示型の表示装置を提供することを目的としたものである。

【００１２】

【課題を解決するための手段】

この発明の表示装置は、表示の観察側とは反対側の面である後面を互いに対向させて逆向きに配置され、それぞれが、表示の観察側である前側から入射した光の透過と遮断を制御する第１と第２の表示素子と、入射光の互いに異なる２つの偏光成分のうち、一方の偏光成分を反射し、他方の偏光成分を透過させる一対の偏光分離素子を有し、前記第１と第２の表示素子の間に、前記一対の偏光分離素子の一方を前記第１の表示素子の後面に対向させ、他方を前記第２の表示素子の後面に対向させて配置され、前記一方の偏光分離素子を透過した偏光成分の光を他方の偏光分離素子により反射し、前記他方の偏光分離素子を透過した偏光成分の光を前記一方の反射偏光素子により反射する反射手段とを備えたことを特徴とする。

【００１３】

この表示装置は、前記第１の表示素子の前面を一方の表示面とする反射表示と、前記第２の表示素子の前面を他方の表示面とする反射表示とを行なうものであり、前記第１の表示素子は、一方の面を表示面とするときに、入射光の透過と遮断を制御するように駆動され、前記第２の表示素子は、他方の面を表示面とするときに、入射光の透過と遮断を制御するように駆動される。

【００１４】

そして、前記一方の面、つまり第１の表示素子の前面を表示面とする反射表示のときは、前記第１の表示素子の前側から入射した光が、この第１の表示素子により透過と遮断を制御され、その遮断により暗表示が得られるとともに、前記第１の表示素子を透過した光が、前記反射手段の第１の表示素子側の一方の偏光分離素子を透過して他方の偏光分離素子により反射され、その反射光が前記一方の偏光分離素子を再び透過し、さらに前記第１の表示素子を透過してその前側に出射して明表示が得られる。

【００１５】

また、前記他方の面、つまり第２の表示素子の前面を表示面とする反射表示のときは、前記第２の表示素子の前側から入射した光が、この第２の表示素子により透過と遮断を制御され、その遮断により暗表示が得られるとともに、前記第２の表示素子を透過した光が、前記反射手段の前記他方の偏光分離素子を透過して前記一方の偏光分離素子により反射され、その反射光が前記他方の偏光分離素子を再び透過し、さらに前記第２の表示素子を透過してその前側に出射して明表示が得られる。

【００１６】

すなわち、この表示装置は、その一方の面（第１の表示素子の前面）を表示面とする反射表示のときは、前記第１の表示素子の前側から入射してこの第１の表示素子を透過した光を、前記反射手段の第１の表示素子側の偏光分離素子を透過させて第２の表示素子側の偏光分離素子により反射し、他方の面（第２の表示素子の前面）を表示面とする反射表示のときは、前記第２の表示素子の前側から入射してこの第２の表示素子を透過した光を、前記反射手段の第２の表示素子側の偏光分離素子を透過させて第１の表示素子側の偏光分離素子により反射するようにしたものである。

【００１７】

この表示装置によれば、前記反射手段の一対の偏光分離素子がそれぞれ、入射光の互いに異なる２つの偏光成分のうち、一方の偏光成分をほとんど吸収すること無く高い反射率で反射し、他方の偏光成分をほとんど吸収すること無く高い透過率で透過させるため、一方と他方のいずれの面を表示面とするときも、充分な明るさの反射表示を行なうことができる。

【００１８】

このように、この発明の表示装置は、表示の観察側である前側から入射した光の透過と遮断を制御する第１と第２の表示素子を、それぞれの後面を互いに対向させて逆向きに配置

し、前記第１と第２の表示素子の間に、入射光の互いに異なる２つの偏光成分のうち、一方の偏光成分を反射し、他方の偏光成分を透過させる一対の偏光分離素子を有し、その一方の偏光分離素子を透過した偏光成分の光を他方の偏光分離素子により反射し、前記他方の偏光分離素子を透過した偏光成分の光を前記一方の反射偏光素子により反射する反射手段を配置することにより、一方と他方のいずれの面を表示面とするときも、充分な明るさの反射表示を行なうことができるようにしたものである。

【００１９】

この発明の表示装置において、前記反射手段の一対の偏光分離素子はそれぞれ、互いに直交する方向に透過軸と反射軸とをもち、入射光の互いに直交する２つの直線偏光成分のうち、前記反射軸に平行な振動面をもった一方の直線偏光成分を反射し、前記透過軸に平行な振動面をもった他方の直線偏光成分を透過させる反射偏光素子が望ましい。

【００２０】

その場合、前記反射手段は、前記一対の反射偏光素子をそれぞれの透過軸を互いに交差させて配置するか、あるいは、前記一対の反射偏光素子の間に、透過光の偏光状態を変化させる位相差板をさらに配置した構成とすればよい。

【００２１】

また、この発明の表示装置において、前記第１と第２の表示素子を、表示の観察側である前側の基板と、この前側基板に対向する後側基板との間に、印加される電界に応じて透過光の偏光状態を制御する液晶層が設けられた液晶セルを挟んでその前後に、互いに直交する方向に透過軸と吸収軸とをもち、入射光の互いに直交する２つの直線偏光成分のうち、前記吸収軸に平行な一方の偏光成分を吸収し、前記透過軸に平行な他方の偏光成分を透過させる一対の吸収偏光板が配置された液晶表示素子とする場合、前記反射手段の一対の反射偏光素子のうち、前記第１の液晶表示素子側の反射偏光素子は、その透過軸を前記第１の液晶表示素子の後側の吸収偏光板の透過軸と実質的に平行にして配置し、前記第２の液晶表示素子側の反射偏光素子は、その透過軸を前記第２の表示素子の後側の吸収偏光板の透過軸と実質的に平行にして配置するのが望ましい。

【００２２】

さらに、この発明の表示装置において、前記反射手段は、入射光の右回りと左回りの２つの円偏光成分のうち、一方の円偏光成分を反射し、他方の円偏光成分を透過させる円偏光分離層と、前記円偏光分離層の一方の面側に配置され、前記円偏光分離層に対向する面とは反対面から入射した直線偏光を円偏光にして前記円偏光分離層に入射させ、前記円偏光分離層から出射した円偏光を直線偏光にして前記反対面から出射する位相差板とからなる一対の偏光分離素子を有し、これらの偏光分離素子を、それぞれの前記円偏光分離層を互いに向き合わせて配置した構成としてもよい。

【００２３】

また、この発明の表示装置において、前記反射手段は、前記一対の偏光分離素子の間に、一方と他方の面から入射した光をそれぞれ透過させ、端面からの入射光を前記一方と他方の少なくとも一方の面から出射する導光板と、この導光板の前記端面に対向させて設けられた発光素子とからなる面光源をさらに配置した構成とするのが望ましい。

【００２４】

なお、前記反射手段に前記面光源を備えさせる場合、前記反射手段を上述したように前記一対の反射偏光素子の間に位相差板を配置した構成とするときは、前記面光源の導光板を前記位相差板としてもよい。

【００２５】

【発明の実施の形態】

図１～図４はこの発明の第１の実施例を示しており、図１は表示装置の分解斜視図、図２及び図３は、前記表示装置の一方の面を表示面とするときと、他方の面を表示面とするときの入射光の透過経路を示す模式図、図４は両面に表示部を有する電子機器の一例を示す斜視図である。

【００２６】

まず、図４に示した電子機器について説明すると、この電子機器は携帯電話機であり、前面に複数のキー２を備えた機器本体１と、一端を前記機器本体１の上縁部に枢支され、前記機器本体１に対して開閉回動可能に設けられた蓋３とからなっており、前記蓋３の内面、つまり、図４（ａ）のように蓋３を閉じたときに機器本体１に対向し、図４（ｂ）のように蓋３を開いたときに前向きになる面と、前記蓋３の外面とに、それぞれ表示部Ａ，Ｂが設けられている。

【００２７】

次に、この発明の第１の実施例の表示装置について説明すると、この実施例の表示装置は、図１に示したように、表示の観察側とは反対側の面である後面を互いに対向させて逆向きに配置され、それぞれが、表示の観察側である前側から入射した光の透過と遮断を制御する第１と第２の表示素子１０Ａ，１０Ｂと、前記第１と第２の表示素子１０Ａ，１０Ｂの間に配置された反射手段２０とを備えている。

【００２８】

前記表示素子１０Ａ，１０Ｂは、例えば液晶表示素子であり、いずれも、表示の観察側である前側の透明基板１２と、この前側基板１２に対向する後側の透明基板１３とが枠状のシール材１４を介して接合され、これらの基板１２，１３間の前記シール材１４で囲まれた領域に、印加される電界に応じて透過光の偏光状態を制御する液晶層１５（図２及び図３参照）が設けられた液晶セル１１と、前記液晶セル１１を挟んでその前後に配置された一対の偏光板１６，１７とからなっている。

【００２９】

なお、図では省略しているが、前記液晶セル１１の前後の基板１２，１３の液晶層１５に対向する内面には、互いに対向する領域によりマトリックス状に配列する複数の画素を形成する透明電極が設けられ、その上に配向膜が設けられている。

【００３０】

この液晶セル１１は、例えばＴＦＴ（薄膜トランジスタ）を能動素子とするアクティブマトリックス液晶セルであり、その一方の基板、例えば後側基板１３の内面に、行方向及び列方向にマトリックス状に配列する複数の画素電極と、これらの画素電極にそれぞれ接続された複数のＴＦＴと、各行のＴＦＴにそれぞれゲート信号を供給する複数のゲート配線と、各列のＴＦＴにそれぞれデータ信号を供給する複数のデータ配線とが設けられ、他方の基板である前側基板１２の内面に、前記複数の画素電極にそれぞれ対向させて交互に並べて形成された複数の色、例えば赤、緑、青の３色のカラーフィルタと、前記複数の画素電極に対向する一枚膜状の対向電極とが設けられている。

【００３１】

また、前記液晶表示素子１０Ａ，１０ＢはいずれもＴＮ（ツイステッドネマティック）型のものであり、その液晶セル１１の液晶層１５は、液晶分子が前後の基板１２，１３間において実質的に９０°のツイスト角でツイスト配向した誘電異方性が正のネマティック液晶からなっている。

【００３２】

図１において、矢印１２ａは前記液晶セル１１の前側基板１２の近傍における液晶分子配向方向、矢印１３ａは後側基板１３の近傍における液晶分子配向方向を示しており、図において上側の第１の液晶表示素子１０Ａの前側基板（図において上側の基板）１２の近傍における液晶分子配向方向１２ａは、互いに平行に設定された第１及び第２の液晶表示素子１０Ａ，１０Ｂの横軸（画面の横軸）ｘに対して一方の方向、例えば前側から見て右回りに実質的に４５°の方向、後側基板（図において下側の基板）１３の近傍における液晶分子配向方向１３ａは、前記横軸ｘに対して他方の方向、つまり前側から見て左回りに実質的に４５°の方向にあり、この第１の液晶表示素子１０Ａの液晶層１５の液晶分子は、そのツイスト方向を図１に破線矢印で示したように、後側基板１３から前側基板１２に向かい、前側から見て右回りに実質的に９０°のツイスト角でツイスト配向している。

【００３３】

一方、図１において下側の第２の液晶表示素子１０Ｂの前側基板（図において下側の基板

）１２の近傍における液晶分子配向方向１２ａは、前記第１の液晶表示素子１０Ａの前側基板１２の近傍における液晶分子配向方向１２ａに対して実質的に直交する方向（横軸ｘに対して前側から見て右回りに実質的に４５°の方向）、後側基板（図において上側の基板）１３の近傍における液晶分子配向方向１３ａは、前記第１の液晶表示素子１０Ａの後側基板１３の近傍における液晶分子配向方向１３ａに対して実質的に直交する方向（横軸ｘに対して前側から見て左回りに実質的に４５°の方向）にあり、この第２の液晶表示素子１０Ｂの液晶層１５の液晶分子は、そのツイスト方向を図１に破線矢印で示したように、後側基板１３から前側基板１２に向かい、前側から見て左回り（図１では後側から見て右回り）に実質的に９０°のツイスト角でツイスト配向している。

【００３４】

なお、前記第１と第２の液晶表示素子１０Ａ，１０Ｂの前側基板１２及び後側基板１３の近傍の液晶分子配向方向１２ａ，１３ａは、上記と逆に、それぞれの液晶表示素子１０Ａ，１０Ｂの前側基板１２の近傍の液晶分子配向方向１２ａを実質的に平行にし、それぞれの液晶表示素子１０Ａ，１０Ｂの後側基板１３の近傍の液晶分子配向方向１３ａを実質的に平行にしてもよい。

【００３５】

また、前記第１と第２の液晶表示素子１０Ａ，１０Ｂの液晶セル１１を挟んで配置された一対の偏光板１６，１７はそれぞれ、互いに直交する方向に透過軸１６ａ，１７ａと吸収軸（図示せず）とをもち、入射光の互いに直交する２つの直線偏光成分のうち、前記吸収軸に平行な振動面をもった一方の直線偏光成分を吸収し、前記透過軸１６ａ，１７ａに平行な振動面をもった他方の直線偏光成分を透過させる吸収偏光板であり、前側の吸収偏光板１６は、その透過軸１６ａを前記液晶セル１１の前側基板１２の近傍における液晶分子配向方向１２ａと実質的に直交または平行（図では直交）にして前記液晶セル１１の前側基板１２の外面に貼付けられ、後側の吸収偏光板１７は、その透過軸１７ａを前記前側の吸収偏光板１６の透過軸１６ａと実質的に直交させて前記液晶セル１１の後側基板１３の外面に貼付けられている。

【００３６】

すなわち、前記第１と第２の液晶表示素子１０Ａ，１０Ｂの前側の吸収偏光板１６は、それぞれの透過軸１６ａを実質的に互いに直交させて配置され、前記第１と第２の液晶表示素子１０Ａ，１０Ｂの対向面側である後側の吸収偏光板１７は、それぞれの透過軸１７ａを実質的に互いに直交させて配置されている。

【００３７】

また、前記第１の液晶表示素子１０Ａと第２の液晶表示素子１０Ｂとの間に配置された反射手段２０は、一対の偏光分離素子２１，２２を有し、さらに、これらの偏光分離素子２１，２２の間に面光源２４を配置した構成となっている。

【００３８】

前記一対の偏光分離素子２１，２２は、例えば、入射光の互いに直交する２つの直線偏光成分のうち、一方の直線偏光成分を反射し、他方の直線偏光成分を透過させる反射偏光素子であり、この実施例では、互いに直交する方向に透過軸２１ａ，２２ａと反射軸２１ｂ，２２ｂとをもち、前記反射軸２１ｂ，２２ｂに平行な振動面をもった直線偏光成分の光を反射し、前記透過軸２１ａ，２２ａに平行な振動面をもった直線偏光成分の光を透過させる反射偏光板を用いている。以下、この偏光分離素子２１，２２を反射偏光素子と言う。

【００３９】

そして、前記一対の反射偏光素子２１，２２は、それぞれの透過軸２１ａ，２２ａを実質的に互いに直交させるとともに、第１の液晶表示素子１０Ａ側の反射偏光素子（以下、第１の反射偏光素子と言う）２１の透過軸２１ａを、前記第１の液晶表示素子１０Ａの後側の吸収偏光板１７の透過軸１７ａと実質的に平行にし、第２の液晶表示素子１０Ｂ側の反射偏光素子（以下、第２の反射偏光素子と言う）２２の透過軸２２ａを、前記第２の液晶表示素子１０Ｂの後側の吸収偏光板１７の透過軸１７ａと実質的に平行にして配置されて

いる。

【００４０】

また、前記第１と第２の反射偏光素子２１，２２の間に配置された面光源２４は、一方と他方の面から入射した光をそれぞれ透過させ、端面からの入射光を前記一方と他方の少なくとも一方の面から出射する導光板２５と、この導光板２５の前記端面に対向させて設けられた発光素子２６とからなっている。

【００４１】

なお、この実施例で用いた面光源２４は、ＬＥＤ（発光ダイオード）からなる複数の前記発光素子２６を前記導光板２５の端面に対向させて配置したものであるが、前記導光板２５の端面に対向させて配置する発光素子は、直管状の冷陰極管等でもよい。

【００４２】

この面光源２４は、前記導光板２５の一方の面から入射した光を透過させてこの導光板２５の他方の面から出射し、前記導光板２５の他方の面から入射した光を透過させてこの導光板２５の一方の面から出射するとともに、前記発光素子２６から出射して前記導光板２５にその端面から入射した光を、この導光板２５の一方及び他方の面と外気（空気）との界面で全反射しながら導光板２５内を導いてその一方の面及び他方の面から出射するものであり、前記発光素子２６は、充分な明るさの外光が得られる環境下で表示装置を使用するときは消灯され、充分な明るさの外光が得られない環境下で表示装置を使用するときに点灯される。

【００４３】

なお、図では省略しているが、前記導光板２５の一方と他方のいずれかの面には、この導光板２５内をその面に向かって進んできた光を、前記導光板面の法線に対する角度が小さくなる方向に反射する複数の溝状凹部が導光板端面と平行に形成されており、したがって、前記導光板２５内を導かれてきた光は、前記導光板２５の前記溝状凹部が形成された面とは反対側の面から主に出射する。

【００４４】

この面光源２４は、前記導光板２５の一方の面を前記第１の反射偏光素子２１に対向させ、前記導光板２５の他方の面を前記第２の反射偏光素子２２に対向させるとともに、前記導光板２５の両方の面と前記第１及び第２の反射偏光素子２１，２２との間にそれぞれ空気層を設けて配置されている。

【００４５】

この表示装置は、例えば図４に示した電子機器（携帯電話機）の蓋３内に、前記液晶表示装置の一方の面側、例えば第１の液晶表示素子１０Ａの前面側（図１において上側）を前記蓋３の内面の表示部Ａの表示部Ａとし、他方の面側、つまり第２の液晶表示素子１０Ｂの前面側（図１において下側）を前記蓋３の外面の表示部Ｂとして実装される。

【００４６】

この表示装置は、前記第１の液晶表示素子１０Ａの前面を一方の表示面とする反射表示と、前記第２の液晶表示素子１０Ｂの前面を他方の表示面とする反射表示とを行なうものであり、前記第１の液晶表示素子１０Ａは、一方の面を表示面とするときに、入射光の透過と遮断を制御するように駆動され、前記第２の液晶表示素子１０Ｂは、他方の面を表示面とするときに、入射光の透過と遮断を制御するように駆動される。

【００４７】

また、この表示装置は、一方の面を表示面とするときも、他方の面を表示面とするときも、充分な明るさの外光が得られる環境下では、表示の観察側である前側から入射した外光を利用する反射表示を行ない、充分な明るさの外光が得られないときに前記反射手段２０の面光源２４から照明光を出射させてその照明光を利用する透過表示を行なうものであり、いずれの表示も、正面方向（画面の法線付近の方向）から観察される。

【００４８】

なお、この実施例の表示装置は、図１に示したように、前記第１と第２の液晶表示素子１０Ａ，１０Ｂをそれぞれ、その前側の吸収偏光板１６の透過軸１６ａと後側の吸収偏光板

１７の透過軸１７ａとを実質的に直交させたものであるため、一方の面を表示面とするときの反射表示と透過表示も、他方の面を表示面とするときの反射表示と透過表示も、前記液晶セル１１の液晶層１５に電界を印加しない無電界時（液晶層１５の液晶分子の配向状態が初期のツイスト配向であるとき）の表示が明表示である、いわゆるノーマリーホワイトモードの表示である。

【００４９】

図２は前記表示装置の一方の面（第１の液晶表示素子１０Ａの前面）を表示面とするときの入射光の透過経路を示す模式図、図３は他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とするときの入射光の透過経路を示す模式図である。

【００５０】

まず、一方の面を表示面とするときの入射光の透過経路を説明すると、図２（ａ）は一方の面を表示面とする反射表示のときの入射光の透過経路を示し、図２（ｂ）は一方の面を表示面とする透過表示のときの入射光の透過経路を示している。

【００５１】

前記一方の面を表示面とする反射表示のときは、図２（ａ）のように、第１の液晶表示素子１０Ａにその前側から入射した外光（非偏光）の互いに直交する２つの直線偏光成分のうち、前記第１の液晶表示素子１０Ａの前側の吸収偏光板１６の吸収軸に平行な振動面をもった直線偏光成分が、この吸収偏光板１６により吸収され、前記吸収偏光板１６の透過軸１６ａに平行な振動面をもった直線偏光成分が、この吸収偏光板１６を透過し、前記吸収偏光板１６の透過軸１６ａに平行な直線偏光Ｓとなって第１の液晶表示素子１０Ａの液晶セル１１にその前側から入射する。

【００５２】

前記液晶セル１１にその前側から入射した直線偏光Ｓは、前記液晶セル１１の電極間に印加される電界により変化する液晶分子の配向状態に応じた液晶層１５の複屈折作用を受けてこの液晶セル１１の後側に出射し、後側の吸収偏光板１７により遮断されるか、あるいは前記後側の吸収偏光板１７を透過して前記第１の液晶表示素子１０Ａの後側に出射する。

【００５３】

すなわち、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）の液晶分子の配向状態は、実質的に９０°のツイスト角のツイスト配向であり、このときは、図２（ａ）の左側に示したように、前記前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｓが、液晶層１５の複屈折作用により実質的に９０°旋光し、後側の吸収偏光板１７の透過軸１７ａに平行な直線偏光Ｐとなって液晶セル１１の後側に出射するため、この無電界時は、前記液晶セル１１の後側に出射した前記直線偏光Ｐが前記後側の吸収偏光板１７を透過して第１の液晶表示素子１０Ａの後側に出射する。

【００５４】

前記第１の液晶表示素子１０Ａの後側に出射した前記直線偏光Ｐは、前記反射手段２０に入射する。

【００５５】

そして、前記反射手段２０の第１の液晶表示素子１０Ａ側の第１の反射偏光素子２１の透過軸２１ａは、前記第１の液晶表示素子１０Ａの後側の吸収偏光板１７の透過軸１７ａと実質的に平行であるため、前記第１の液晶表示素子１０Ａの後側に出射して前記反射手段２０に入射した前記直線偏光Ｐは、そのほとんどが前記第１の反射偏光素子２１を透過する。

【００５６】

前記第１の反射偏光素子２１を透過した前記直線偏光Ｐは、面光源２４の導光板２５を透過して前記反射手段２０の第２の反射偏光素子２２に入射し、この第２の反射偏光素子２２により反射される。

【００５７】

すなわち、前記第１の反射偏光素子２１と第２の反射偏光素子２２の透過軸２１ａ，２２ ａは実質的に互いに直交しているため、前記第１の反射偏光素子２１を透過して第２の反射偏光素子２２に入射する前記直線偏光Ｐは、前記第２の反射偏光素子２２の反射軸２２ｂに平行な振動面をもった直線偏光成分の光であり、したがって、その光のほとんどが、前記第２の反射偏光素子２２により反射される。

【００５８】

前記第２の反射偏光素子２２により反射された前記直線偏光Ｐは、前記面光源２４の導光板２５を再び透過し、さらに前記第１の反射偏光素子２１を透過して前記反射手段２０の第１の液晶表示素子１０Ａに対向する面から出射し、前記第１の液晶表示素子１０Ａにその後側から入射する。

【００５９】

前記第１の液晶表示素子１０Ａにその後側から入射した直線偏光Ｐは、この第１の液晶表示素子１０Ａの後側の吸収偏光板１７を透過し、液晶セル１１の液晶層１５により実質的に９０°旋光されて前側の吸収偏光板１６の透過軸１６ａに平行な直線偏光Ｓとなり、前記前側の吸収偏光板１６を透過して前記第１の液晶表示素子１０Ａの前側に出射する。

【００６０】

一方、前記第１の液晶表示素子１０Ａの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図２（ａ）の右側に示したように、第１の液晶表示素子１０Ａの前側から入射し、その前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｓが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前記液晶セル１１を透過して後側の吸収偏光板１７に入射し、この吸収偏光板１７により吸収される。

【００６１】

したがって、前記一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする反射表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【００６２】

また、前記一方の面を表示面とする透過表示のときは、前記反射手段２０の面光源２４の発光素子２６が点灯され、前記発光素子２６からの出射光が、図２（ｂ）のように、導光板２５にその端面から入射し、この導光板２５の一方と他方の面とその外側の空気層との界面で全反射しながら導光板２５内を導かれ、前記導光板２５の一方の面と他方の面から出射する。

【００６３】

そして、前記導光板２５の第１の反射偏光素子２１に対向する面から出射した照明光は、前記第１の反射偏光素子２１に入射し、その光（非偏光）のうち、前記第１の反射偏光素子２１の反射軸２１ｂに平行な直線偏光Ｓが、この第１の反射偏光素子２１により反射され、前記第１の反射偏光素子２１の透過軸２１ａに平行な直線偏光Ｐが、この第１の反射偏光素子２１を透過して前記第１の液晶表示素子１０Ａ側に出射する。

【００６４】

また、前記導光板２５の第２の反射偏光素子２２に対向する面から出射した照明光は、透過軸２２ａを前記第１の反射偏光素子２１の透過軸２１ａに対して実質的に直交させて配置されている前記第２の反射偏光素子２２に入射し、その光（非偏光）のうち、前記第２の反射偏光素子２２の透過軸２２ａに平行な直線偏光Ｓが、この第２の反射偏光素子２２を透過して第２の液晶表示素子１０Ｂ側に出射し、前記第２の反射偏光素子２２の反射軸２２ｂに平行な直線偏光Ｐが、この第２の反射偏光素子２２により反射される。

【００６５】

前記第２の反射偏光素子２２により反射された直線偏光Ｐは、前記導光板２５を透過し、さらに第１の反射偏光素子２１を透過して第１の液晶表示素子１０Ａ側に出射する。

【００６６】

一方、前記導光板２５の第１の反射偏光素子２１に対向する面から出射した照明光のうち、前記第１の反射偏光素子２１により反射された前記直線偏光Ｓは、前記導光板２５を透

過し、さらに前記第２の反射偏光素子２２を透過して第２の液晶表示素子１０Ｂ側に出射する。

【００６７】

このように、前記反射手段２０は、面光源２４からの照明光のうち、前記導光板２５の第１の反射偏光素子２１に対向する面から出射して前記第１の反射偏光素子２１を透過した直線偏光Ｐと、前記導光板２５の第２の反射偏光素子２２に対向する面から出射し、前記第２の反射偏光素子２２により反射されて前記第１の反射偏光素子２１を透過した直線偏光Ｐとを、前記第１の液晶表示素子１０Ａ側に出射するとともに、前記導光板２５の第２の反射偏光素子２２に対向する面から出射して前記第２の反射偏光素子２２を透過した直線偏光Ｓと、前記導光板２５の第１の反射偏光素子２１に対向する面から出射し、前記第１の反射偏光素子２１により反射されて前記第２の反射偏光素子２２を透過した直線偏光Ｓとを、前記第２の液晶表示素子１０Ｂ側に出射する。

【００６８】

すなわち、この反射手段２０は、前記面光源２４からの照明光の約５０％を、直線偏光Ｐとして第１の液晶表示素子１０Ａ側に出射し、他の約５０％を、直線偏光Ｓとして第２の液晶表示素子１０Ｂ側に出射する。

【００６９】

したがって、この反射手段２０から第１の液晶表示素子１０Ａ側に出射する直線偏光Ｐと、前記第２の液晶表示素子１０Ｂ側に出射する直線偏光Ｓは、略同じ強度の光である。

【００７０】

なお、上述したように、前記導光板２５は、この導光板２５内を導かれてきた光を、図示しない溝状凹部が形成された面とは反対側の面から主に出射するが、前記導光板２５の第１の反射偏光素子２１に対向する面から出射した光の約５０％と、第２の反射偏光素子２２に対向する面から出射した光の約５０％が直線偏光Ｐとなって第１の液晶表示素子１０Ａ側に出射し、他の約５０％ずつの光が直線偏光Ｓとなって第２の液晶表示素子１０Ｂ側に出射するため、前記導光板２５が、前記溝状凹部の形成面を前記第１と第２の反射偏光素子２１，２２のいずれに対向させて配置されていても、実質的に同じ強度の直線偏光Ｐと直線偏光Ｓを、第１の液晶表示素子１０Ａ側と第２の液晶表示素子１０Ｂ側とに出射することができる。

【００７１】

そして、前記反射手段２０から第１の液晶表示素子１０Ａ側に出射した直線偏光Ｐは、この第１の液晶表示素子１０Ａの後側の吸収偏光板１７を透過して液晶セル１１にその後側から入射し、前記液晶セル１１の電極間に印加される電界により変化する液晶分子の配向状態に応じた液晶層１５の複屈折作用を受けて前記液晶セル１１の前側に出射する。

【００７２】

すなわち、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図２（ｂ）の左側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｐが、液晶層１５の複屈折作用により実質的に９０°旋光し、前側の吸収偏光板１６の透過軸１６ａに平行な直線偏光Ｓとなって液晶セル１１の前側に出射し、前記前側の吸収偏光板１６を透過して前記第１の液晶表示素子１０Ａの前側に出射する。

【００７３】

一方、前記第１の液晶表示素子１０Ａの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図２（ｂ）の右側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｐが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前記液晶セル１１を透過して前側の吸収偏光板１６に入射し、この吸収偏光板１６により吸収される。

【００７４】

したがって、前記一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする透過表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【００７５】
なお、前記一方の面、つまり第１の液晶表示素子１０Ａの前面を表示面とする表示のときは、第２の液晶表示素子１０Ｂの液晶セル１１は無電界（Ｖ＝０）の非駆動状態にあるため、前記一方の面を表示面とする透過表示のときに前記反射手段２０から第２の液晶表示素子１０Ｂ側に出射した直線偏光Ｓは、この第２の液晶表示素子１０Ｂの後側の吸収偏光板１７を透過して液晶セル１１にその後側から入射し、液晶層１５の複屈折作用により実質的に９０°旋光され、前側の吸収偏光板１６を透過して前記第２の液晶表示素子１０Ｂの前側（表示装置の他方の面側）に出射するが、前記一方の面を表示面とする表示、つまり図４に示した電子機器の蓋内面の表示部Ａの表示は、図４（ｂ）のように蓋３を開いた状態でその内面方向から観察されるため、前記第２の液晶表示素子１０Ｂの前側から出射する光は見えない。

【００７６】
次に、他方の面を表示面とするときの入射光の透過経路を説明すると、図３（ａ）は他方の面を表示面とする反射表示のときの入射光の透過経路を示し、図３（ｂ）は他方の面を表示面とする透過表示のときの入射光の透過経路を示している。

【００７７】
他方の面を表示面とする反射表示のときは、図３（ａ）のように、第２の液晶表示素子１０Ｂにその前側から入射した外光（非偏光）の互いに直交する２つの直線偏光成分のうち、前記第２の液晶表示素子１０Ｂの前側の吸収偏光板１６の吸収軸に平行な振動面をもった直線偏光成分が、この吸収偏光板１６により吸収され、前記吸収偏光板１６の透過軸１６ａに平行な振動面をもった直線偏光成分が、この吸収偏光板１６を透過し、前記吸収偏光板１６の透過軸１６ａに平行な直線偏光Ｐとなって第２の液晶表示素子１０Ｂの液晶セル１１にその前側から入射する。

【００７８】
前記液晶セル１１にその前側から入射した直線偏光Ｐは、前記液晶セル１１の電極間に印加される電界により変化する液晶分子の配向状態に応じた液晶層１５の複屈折作用を受けてこの液晶セル１１の後側に出射し、後側の吸収偏光板１７により遮断されるか、あるいは前記後側の吸収偏光板１７を透過して前記第２の液晶表示素子１０Ｂの後側に出射する。

【００７９】
すなわち、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）の液晶分子の配向状態は、実質的に９０°のツイスト角のツイスト配向であり、このときは、図３（ａ）の左側に示したように、前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｐが、液晶層１５の複屈折作用により実質的に９０°旋光し、後側の吸収偏光板１７の透過軸１７ａに平行な直線偏光Ｓとなって液晶セル１１の後側に出射するため、この無電界時は、前記液晶セル１１の後側に出射した前記直線偏光Ｓが前記後側の吸収偏光板１７を透過して前記第２の液晶表示素子１０Ｂの後側に出射する。

【００８０】
前記第２の液晶表示素子１０Ｂの後側に出射した前記直線偏光Ｓは、前記反射手段２０に入射する。

【００８１】
そして、前記反射手段２０の第２の液晶表示素子１０Ｂ側の第２の反射偏光素子２２の透過軸２２ａは、前記第２の液晶表示素子１０Ｂの後側の吸収偏光板１７の透過軸１７ａと実質的に平行であるため、前記第２の液晶表示素子１０Ｂの後側に出射して前記反射手段２０に入射した前記直線偏光Ｓは、そのほとんどが前記第２の反射偏光素子２２を透過する。

【００８２】
前記第２の反射偏光素子２２を透過した前記直線偏光Ｓは、面光源２４の導光板２５を透過して前記反射手段２０の第１の反射偏光素子２１に入射し、この第１の反射偏光素子２１により反射される。

【００８３】
すなわち、前記第２の反射偏光素子２２と第１の反射偏光素子２１の透過軸２２ａ，２１ａは実質的に互いに直交しているため、前記第２の反射偏光素子２２を透過して第１の反射偏光素子２１に入射する前記直線偏光Ｓは、前記第１の反射偏光素子２１の反射軸２１ｂに平行な振動面をもった直線偏光成分の光であり、したがって、その光のほとんどが、前記第１の反射偏光素子２１により反射される。

【００８４】
そして、前記第１の反射偏光素子２１により反射された前記直線偏光Ｓは、前記面光源２４の導光板２５を再び透過し、さらに前記第２の反射偏光素子２２を透過して前記反射手段２０の第２の液晶表示素子１０Ｂに対向する面から出射し、前記第２の液晶表示素子１０Ｂにその後側から入射する。

【００８５】
前記第２の液晶表示素子１０Ｂに入射した直線偏光Ｓは、この第２の液晶表示素子１０Ｂの後側の吸収偏光板１７を透過し、液晶セル１１の液晶層１５により実質的に９０°旋光されて前側の吸収偏光板１６の透過軸１６ａに平行な直線偏光Ｐとなり、前記前側の吸収偏光板１６を透過して前記第２の液晶表示素子１０Ｂの前側に出射する。

【００８６】
一方、前記第２の液晶表示素子１０Ｂの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図３（ａ）の右側に示したように、第２の液晶表示素子１０Ｂの前側から入射し、その前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｐが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前記液晶セル１１を透過して後側の吸収偏光板１７に入射し、この後側の吸収偏光板１７により吸収される。

【００８７】
したがって、前記他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする反射表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【００８８】
また、前記他方の面を表示面とする透過表示のときは、上述した一方の面を表示面とする透過表示のときと同様に、前記反射手段２０の面光源２４の発光素子２６が点灯され、前記反射手段２０から第１の液晶表示素子１０Ａ側に直線偏光Ｐが出射し、第２の液晶表示素子１０Ｂ側に直線偏光Ｓが出射する。

【００８９】
そして、前記反射手段２０から第２の液晶表示素子１０Ｂ側に出射した直線偏光Ｓは、この第２の液晶表示素子１０Ｂの後側の吸収偏光板１７を透過して液晶セル１１にその後側から入射し、前記液晶セル１１の電極間に印加される電界により変化する液晶分子の配向状態に応じた液晶層１５の複屈折作用を受けてこの液晶セル１１の前側に出射する。

【００９０】
すなわち、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図３（ｂ）の左側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｓが、液晶層１５の複屈折作用により実質的に９０°旋光して前側の吸収偏光板１６の透過軸１６ａに平行な直線偏光Ｐとなり、その直線偏光Ｐが、前記前側の吸収偏光板１６を透過して前記第２の液晶表示素子１０Ｂの前側に出射する。

【００９１】
一方、前記第２の液晶表示素子１０Ｂの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図３（ｂ）の右側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｓが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前記液晶セル１１を透過して前側の吸収偏光板１６に入射し、この吸収偏光板１６により吸収される。

【００９２】

したがって、前記他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする透過表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【００９３】

なお、前記他方の面、つまり第２の液晶表示素子１０Ｂの前面を表示面とする表示のときは、第１の液晶表示素子１０Ａの液晶セル１１は無電界（Ｖ＝０）の非駆動状態にあるため、前記他方の面を表示面とする透過表示のときに前記反射手段２０から第１の液晶表示素子１０Ａ側に出射した直線偏光Ｐは、この第１の液晶表示素子１０Ａの後側の吸収偏光板１７を透過して液晶セル１１にその後側から入射し、液晶層１５の複屈折作用により実質的に９０°旋光され、前側の吸収偏光板１６を透過して前記第１の液晶表示素子１０Ａの前側（表示装置の一方の面側）に出射するが、前記他方の面を表示面とする表示、つまり図４に示した電子機器の蓋外面の表示部Ｂの表示は、図４（ａ）のように蓋３を閉じた状態で観察されるため、前記第２の液晶表示素子１０Ｂの前側から出射する光は見えない。

【００９４】

このように、この表示装置は、その一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする反射表示のときは、前記第１の液晶表示素子１０Ａの前側から入射してこの第１の液晶表示素子１０Ａを透過した光を、前記反射手段２０の第１の液晶表示素子１０Ａ側の反射偏光素子２１を透過させて第２の液晶表示素子１０Ｂ側の反射偏光素子２２により反射し、他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする反射表示のときは、前記第２の液晶表示素子１０Ｂの前側から入射してこの第２の液晶表示素子１０Ｂを透過した光を、前記反射手段２０の第２の液晶表示素子１０Ｂ側の反射偏光素子２２を透過させて第１の液晶表示素子１０Ａ側の反射偏光素子２１により反射するようにしたものである。

【００９５】

この表示装置によれば、前記反射手段２０の一対の反射偏光素子２１，２２がそれぞれ、入射光の互いに異なる２つの直線偏光成分のうち、一方の直線偏光成分をほとんど吸収すること無く高い反射率で反射し、他方の直線偏光成分をほとんど吸収すること無く高い透過率で透過させるため、一方と他方のいずれの面を表示面とするときも、充分な明るさの反射表示を行なうことができる。

【００９６】

しかも、この実施例では、前記反射手段２０の一対の反射偏光素子２１，２２を、それぞれの透過軸２１ａ，２２ａを実質的に互いに直交させて、つまり一方の反射偏光素子２１の透過軸２１ａと他方の反射偏光素子２２の反射軸２２ｂとを実質的に互いに平行にして配置しているため、前記一方の面を表示面とする反射表示のときに、前記第１の液晶表示素子１０Ａを透過して前記反射手段２０にその一方の面から入射した直線偏光Ｐのほとんどをこの反射手段２０により反射するとともに、前記他方の面を表示面とする反射表示のときに、前記第２の液晶表示素子１０Ｂを透過して前記反射手段２０にその他方の面から入射した直線偏光Ｓのほとんどをこの反射手段２０により反射することができ、したがって、一方と他方のいずれの面を表示面とするときも、その表示をより明るくすることができる。

【００９７】

なお、前記反射手段２０は、一対の反射偏光素子２１，２２のうち、一方の反射偏光素子を透過して入射し、他方の反射偏光素子により反射されて前記一方の反射偏光素子に再入射した光のほとんどを、この一方の反射偏光素子を透過させて出射するが、前記一方の反射偏光素子に再入射した光のうち、一部の光は、この一方の反射偏光素子により反射され、一対の反射偏光素子２１，２２の間で多重反射されて前記一方の反射偏光素子を透過して出射する。

【００９８】

すなわち、前記反射手段２０は、その一方と他方のいずれの面から入射した光の大部分を

、その入射側とは反対側の反射偏光素子２２または２１による１回の反射で前記入射側に出射するとともに、一部の光を一対の反射偏光素子２１，２２の間で多重反射させ、その多重反射光を、前記１回の反射で出射する光の周囲から前記入射側に出射する。

【００９９】

そのため、この表示装置によれば、その一方と他方のいずれの面を表示面とするときも、前記反射手段２０の入射側とは反対側の反射偏光素子２１または２２による１回の反射で前記反射手段２０の入射側に出射した反射光と、前記反射手段２０の一対の反射偏光素子２１，２２の間で多重反射され、前記１回の反射で出射する光の周囲から前記反射手段２０の入射側に出射した反射光とを前記表示面から出射させることができ、したがって、明表示部からの光の出射面積を大きくし、前記明表示部を全体的に明るくするとともに、前記液晶表示素子１０Ａ，１０Ｂによる暗表示の影を無くし、二重像の無い良好な品質の反射表示を行なうことができる。

【０１００】

また、この実施例の表示装置は、前記反射手段２０を、前記一対の反射偏光素子２１，２２の間に、一方と他方の面から入射した光をそれぞれ透過させ、端面からの入射光を前記一方と他方の少なくとも一方の面から出射する導光板２５と、この導光板２５の前記端面に対向させて設けられた発光素子２６とからなる面光源２４をさらに配置した構成としているため、前記一方の面と他方の面の両方でそれぞれ、外光を利用する反射表示と、前記面光源２４からの照明光を利用する透過表示とを行なうことができる。

【０１０１】

そして、前記反射手段２０は、上述したように、第１の液晶表示素子１０Ａ側と、第２の液晶表示素子１０Ｂ側とに、略同じ強度の直線偏光Ｐと直線偏光Ｓをそれぞれ出射するため、前記一方の面を表示面とする透過表示のときも、前記他方の面を表示面とする透過表示のときも、同じ明るさの表示を得ることができる。

【０１０２】

しかも、この実施例では、前記反射手段２０の一対の反射偏光素子２１，２２のうち、前記第１の液晶表示素子１０Ａ側の反射偏光素子２１を、その透過軸２１ａを前記第１の液晶表示素子１０Ａの後側の吸収偏光板１７の透過軸１７ａと実質的に平行にして配置し、前記第２の液晶表示素子１０Ｂ側の反射偏光素子２２を、その透過軸２２ａを前記第２の液晶表示素子１０Ｂの後側の吸収偏光板１７の透過軸１７ａと実質的に平行にして配置しているため、前記液晶表示素子１０Ａ，１０Ｂの後側に出射した光のほとんどを前記反射偏光素子２１，２２に入射させるとともに、前記反射偏光素子２１，２２からの出射した光のほとんどを前記液晶表示素子１０Ａ，１０Ｂに入射させることができ、したがって、前記反射表示のときも透過表示のときも、一方と他方の両方の表示を充分に明るくすることができる。

【０１０３】

なお、上記実施例では、前記反射手段２０の一対の反射偏光素子２１，２２を、それぞれの透過軸２１ａ，２２ａを実質的に互いに直交させて配置しているが、前記一対の反射偏光素子２１，２２をそれぞれの透過軸２１ａ，２２ａを斜めに交差させて配置し、これらの反射偏光素子２１，２２の間で多重反射されて反射手段２０から出射する光を多くしてもよく、その場合でも、前記一対の反射偏光素子２１，２２の透過軸２１ａ，２２ａの交差角を直交に近い角度とし、前記反射手段２０の入射側とは反対側の反射偏光素子による１回の反射で出射する光を充分に確保することにより、一方の面を表示面とする反射表示及び透過表示のときも、他方の面を表示面とする反射表示及び透過表示のときも、充分な明るさの表示を得ることができる。

【０１０４】

図５～図７はこの発明の第２の実施例を示しており、図５は表示装置の分解斜視図、図６及び図７は、前記表示装置の一方の面を表示面とするときと、他方の面を表示面とするときの入射光の透過経路を示す模式図である。

【０１０５】

この実施例の表示装置は、図５に示したように、それぞれの後面を互いに対向させて逆向きに配置された第１と第２の液晶表示素子１０Ａ，１０Ｂの間に、一対の反射偏光素子２１，２２の間に位相差板２３と面光源２４を備えた反射手段２０ａを配置したものである。

【０１０６】
なお、この実施例において、前記第１の液晶表示素子１０Ａと第２の液晶表示素子１０Ｂは、基本的に上述した第１の実施例のものと同じ構成のＴＮ型液晶表示素子であり、また、前記反射手段２０ａの面光源２４も第１の実施例のものと同じ構成であるから、その説明は図に同符号を付して省略する。

【０１０７】
この実施例において、前記反射手段２０ａの第１と第２の反射偏光素子２１，２２の間に配置された位相差板２３は、例えば透過光の常光と異常光との間に１／２波長の位相差を与えるλ／２位相差板であり、この実施例では、前記λ／２位相差板２３を、前記第２の反射偏光素子２２と面光源２４の導光板２５との間に配置している。

【０１０８】
また、この実施例では、図５に示したように、前記第１と第２の液晶表示素子１０Ａ，１０Ｂのそれぞれの前側基板１２の近傍における液晶分子配向方向１２ａと、それぞれの後側基板１３の近傍における液晶分子配向方向１３ａとを、それぞれ実質的に平行または直交（図では平行）にするとともに、前記第１と第２の液晶表示素子１０Ａ，１０Ｂの前側の吸収偏光板１６を、それぞれの透過軸１６ａを実質的に平行にして配置し、前記第１と第２の液晶表示素子１０Ａ，１０Ｂの対向面側である後側の吸収偏光板１７を、それぞれの透過軸１７ａを実質的に平行にして配置している。

【０１０９】
さらに、この実施例では、前記反射手段２０ａの第１と第２の反射偏光素子２１，２２を、それぞれの透過軸２１ａ，２１ａを実質的に平行にするとともに、第１の液晶表示素子１０Ａ側の第１の反射偏光素子の透過軸２１ａを前記第１の液晶表示素子１０Ａの後側の吸収偏光板１７の透過軸１７ａと実質的に平行にし、第２の液晶表示素子１０Ｂ側の第２の反射偏光素子の透過軸２２ａを前記第２の液晶表示素子１０Ｂの後側の吸収偏光板１７の透過軸１７ａと実質的に平行にして配置し、前記λ／２位相差板２３を、その遅相軸２３ａを前記第１と第２の反射偏光素子２１，２２の両方の透過軸２１ａ，２２ａに対して実質的に４５°の角度で斜めにずらして配置している。

【０１１０】
この表示装置の反射表示の一方の面（第１の液晶表示素子１０Ａの前面）を表示面とするときの入射光の透過経路を説明すると、図６（ａ）は一方の面を表示面とする反射表示のときの入射光の透過経路を示し、図６（ｂ）は一方の面を表示面とする透過表示のときの入射光の透過経路を示している。

【０１１１】
前記一方の面を表示面とする反射表示のときは、図６（ａ）のように、第１の液晶表示素子１０Ａにその前側から入射した外光（非偏光）が、この第１の液晶表示素子１０Ａの前側の吸収偏光板１６により、その透過軸１６ａに平行な直線偏光Ｓとされて液晶セル１１に入射する。

【０１１２】
そして、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図６（ａ）の左側に示したように、前記液晶セル１１に入射した前記直線偏光Ｓが、液晶層１５により実質的に９０°旋光されて後側の吸収偏光板１７の透過軸１７ａに平行な直線偏光Ｐとなり、前記後側の吸収偏光板１７を透過して前記第１の液晶表示素子１０Ａの後側に出射して、前記反射手段２０ａに入射する。

【０１１３】
前記反射手段２０ａに入射した直線偏光Ｐは、前記反射手段２０ａの第１の反射偏光素子２１と面光源２４の導光板２５とを透過して前記λ／２位相差板２３により１／２波長の

位相差を与えられ、前記直線偏光Ｐの振動面が実質的に９０°回転した直線偏光Ｓとなって第２の反射偏光素子２２に入射して、この第２の反射偏光素子２２により反射される。

【０１１４】

前記第２の反射偏光素子２２により反射された直線偏光Ｓは、前記λ／２位相差板２３により再び直線偏光Ｐとされ、面光源２４の導光板２５と第１の反射偏光素子２１とを透過して前記反射手段２０ａから出射し、前記第１の液晶表示素子１０Ａを再び透過してその前側に出射する。

【０１１５】

一方、前記第１の液晶表示素子１０Ａの液晶セル１１の電極間に液晶分子を基板３，４面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図６（ａ）の右側に示したように、第１の液晶表示素子１０Ａの前側から入射し、その前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｓが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前記液晶セル１１を透過して後側の吸収偏光板１７に入射し、その光のほとんどが前記後側の吸収偏光板１７により吸収される。

【０１１６】

したがって、前記一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする反射表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【０１１７】

また、前記一方の面を表示面とする透過表示のときは、前記反射手段２０ａの面光源２４の発光素子２６が点灯され、前記発光素子２６からの出射光が、図６（ｂ）のように、導光板２５の一方と他方の面から出射する。

【０１１８】

そして、前記導光板２５の第１の反射偏光素子２１に対向する面から出射した照明光は、前記第１の反射偏光素子２１に入射し、その光（非偏光）のうち、前記第１の反射偏光素子２１の反射軸２１ｂに平行な直線偏光Ｓが、この第１の反射偏光素子２１により反射され、前記第１の反射偏光素子２１の透過軸２１ａに平行な直線偏光Ｐが、この第１の反射偏光素子２１を透過して第１の液晶表示素子１０Ａ側に出射する。

【０１１９】

一方、前記導光板２５の第１の反射偏光素子２１に対向する面から出射した光のうち、前記第１の反射偏光素子２１により反射された直線偏光Ｓは、前記導光板２５を透過して前記λ／２位相差板２３により前記直線偏光Ｓの振動面が実質的に９０°回転した直線偏光Ｐとされ、第２の反射偏光素子２２を透過して第２の液晶表示素子１０Ｂ側に出射する。

【０１２０】

また、前記導光板２５の第２の反射偏光素子２２に対向する面から出射した照明光は、前記λ／２位相差板２３を非偏光状態のまま透過して前記第２の反射偏光素子２２に入射し、その光（非偏光）のうち、前記第２の反射偏光素子２２の反射軸２２ｂに平行な直線偏光Ｓが、この第２の反射偏光素子２２により反射され、前記第２の反射偏光素子２２の透過軸２２ａに平行な直線偏光Ｐが、この第２の反射偏光素子２２を透過して第２の液晶表示素子１０Ｂ側に出射する。

【０１２１】

一方、前記導光板２５の第２の反射偏光素子２２に対向する面から出射した光のうち、前記第２の反射偏光素子２２により反射された直線偏光Ｓは、前記λ／２位相差板２３により前記直線偏光Ｓの振動面が実質的に９０°回転した直線偏光Ｐとされ、前記導光板２５を透過し、さらに第１の反射偏光素子２１を透過して第１の液晶表示素子１０Ａ側に出射する。

【０１２２】

すなわち、この実施例では、前記反射手段２２ａを、第１と第２の反射偏光素子２１，２２の透過軸２１ａ，２１ａを実質的に平行にし、その間に、面光源２４と前記λ／２位相差板２３とを配置した構成としているため、この反射手段２０ａから第１の液晶表示素子

１０Ａ側に出射する光と、前記第２の液晶表示素子１０Ｂ側に出射する光は、いずれも直線偏光Ｐである。

【０１２３】

また、この反射手段２０ａは、面光源２４からの照明光のうち、前記導光板２５の第１の反射偏光素子２１に対向する面から出射して前記第１の反射偏光素子２１を透過した直線偏光Ｐと、前記導光板２５の第２の反射偏光素子２２に対向する面から出射して前記第２の反射偏光素子２２により反射され、λ／２位相差板２３により偏光状態を変えられた直線偏光Ｐとを、前記第１の液晶表示素子１０Ａ側に出射するとともに、前記導光板２５の第２の反射偏光素子２２に対向する面から出射して前記第２の反射偏光素子２２を透過した直線偏光Ｐと、前記導光板２５の第１の反射偏光素子２１に対向する面から出射して前記第１の反射偏光素子２１により反射され、前記λ／２位相差板２３により偏光状態を変えられた直線偏光Ｐとを、前記第２の液晶表示素子１０Ｂ側に出射するため、この反射手段２０ａから第１の液晶表示素子１０Ａ側に出射する直線偏光Ｐと、前記第２の液晶表示素子１０Ｂ側に出射する直線偏光Ｐは、略同じ強度の光である。

【０１２４】

そして、前記反射手段２０から第１の液晶表示素子１０Ａ側に出射した直線偏光Ｐは、この第１の液晶表示素子１０Ａの後側の吸収偏光板１７を透過して液晶セル１１にその後側から入射し、前記液晶セル１１の電極間に印加される電界により変化する液晶分子の配向状態に応じた液晶層１５の複屈折作用を受けてこの液晶セル１１の前側に出射する。

【０１２５】

すなわち、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図６（ｂ）の左側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｐが、液晶層１５の複屈折作用により実質的に９０°旋光して直線偏光Ｓとなり、その直線偏光Ｓが前側の吸収偏光板１６を透過して前記第１の液晶表示素子１０Ａの前側に出射する。

【０１２６】

一方、前記第１の液晶表示素子１０Ａの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図６（ｂ）の右側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｐが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前側の吸収偏光板１６に入射し、その光のほとんどが前記前側の吸収偏光板１６により吸収される。

【０１２７】

したがって、前記一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする透過表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【０１２８】

次に、他方の面を表示面とするときの入射光の透過経路を説明すると、図７（ａ）は他方の面を表示面とする反射表示のときの入射光の透過経路を示し、図７（ｂ）は他方の面を表示面とする透過表示のときの入射光の透過経路を示している。

【０１２９】

前記他方の面を表示面とする反射表示のときは、図７（ａ）のように、第２の液晶表示素子１０Ｂにその前側から入射した外光（非偏光）が、この第２の液晶表示素子１０Ｂの前側の吸収偏光板１６により、その透過軸１６ａに平行な直線偏光Ｓとされて液晶セル１１に入射する。

【０１３０】

そして、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図７（ａ）の左側に示したように、前記前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｓが、実質的に９０°旋光して直線偏光Ｐとなり、その直線偏光Ｐが、後側の吸収偏光板１７を透過して前記第２の液晶表示素子１０Ｂの後側に出射する。

【０１３１】

前記第２の液晶表示素子１０Ｂの後側に出射した前記直線偏光Ｐは、前記反射手段２０ａ

に入射し、その第２の反射偏光素子２２を透過して前記λ／２位相差板２３により前記直線偏光Ｐの振動面が実質的に９０°回転した直線偏光Ｓとされ、面光源２４の導光板２５を透過して第１の反射偏光素子２１により反射される。

【０１３２】

前記第１の反射偏光素子２１により反射された前記直線偏光Ｓは、前記導光板２５を再び透過して前記λ／２位相差板２３により再び直線偏光Ｐとされ、前記第２の反射偏光素子２２を透過して前記反射手段２０ａの第２の液晶表示素子１０Ｂに対向する面から出射し、前記第２の液晶表示素子１０Ｂにその後側から入射する。

【０１３３】

前記第２の液晶表示素子１０Ｂに入射した直線偏光Ｓは、この第２の液晶表示素子１０Ｂの後側の吸収偏光板１７を透過し、液晶セル１１の液晶層１５により実質的に９０°旋光されて直線偏光Ｓとなり、前側の吸収偏光板１６を透過して前記第２の液晶表示素子１０Ｂの前側に出射する。

【０１３４】

一方、前記第２の液晶表示素子１０Ｂの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図７（ａ）の右側に示したように、第２の液晶表示素子１０Ｂの前側から入射し、その前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｓが、液晶層１５の複屈折作用を受けずにその偏光状態のまま後側の吸収偏光板１７に入射し、この吸収偏光板１７により吸収される。

【０１３５】

したがって、前記他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする反射表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【０１３６】

また、前記他方の面を表示面とする透過表示のときは、上述した一方の面を表示面とする透過表示のときと同様に、前記反射手段２０ａの面光源２４の発光素子２６が点灯され、前記反射手段２０ａから第１の液晶表示素子１０Ａ側と、第２の液晶表示素子１０Ｂ側とに、それぞれ直線偏光Ｐが出射する。

【０１３７】

そして、前記反射手段２０ａから第２の液晶表示素子１０Ｂ側に出射した直線偏光Ｐは、この第２の液晶表示素子１０Ｂの後側の吸収偏光板１７を透過して液晶セル１１にその後側から入射し、前記液晶セル１１の電極間に印加される電界により変化する液晶分子の配向状態に応じた液晶層１５の複屈折作用を受けてこの液晶セル１１の前側に出射する。

【０１３８】

すなわち、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図７（ｂ）の左側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｐが、液晶層１５により実質的に９０°旋光し、前側の吸収偏光板１６の透過軸１６ａに平行な直線偏光Ｓとなって液晶セル１１の前側に出射し、前側の吸収偏光板１６を透過して前記第２の液晶表示素子１０Ｂの前側に出射する。

【０１３９】

一方、前記第２の液晶表示素子１０Ｂの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図７（ｂ）の右側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｐが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前記液晶セル１１を透過して前側の吸収偏光板１６に入射し、この吸収偏光板１６により吸収される。

【０１４０】

したがって、前記他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする透過表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【０１４１】
このように、この実施例の表示装置は、第１と第２の液晶表示素子１０Ａ，１０Ｂの間に、一対の反射偏光素子２１，２２の間に透過光の偏光状態を変化させる位相差板２３を備えた反射手段２０ａを配置することにより、一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする反射表示のときは、前記第１の液晶表示素子１０Ａの前側から入射してこの第１の液晶表示素子１０Ａを透過した光を、前記反射手段２０ａの第１の液晶表示素子１０Ａ側の反射偏光素子２１を透過させて第２の液晶表示素子１０Ｂ側の反射偏光素子２２により反射し、他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする反射表示のときは、前記第２の液晶表示素子１０Ｂの前側から入射してこの第２の液晶表示素子１０Ｂを透過した光を、前記反射手段２０ａの第２の液晶表示素子１０Ｂ側の反射偏光素子２２を透過させて第１の液晶表示素子１０Ａ側の反射偏光素子２１により反射するようにしたものである。

【０１４２】
この表示装置によれば、前記反射手段２０ａの一対の反射偏光素子２１，２２がそれぞれ、入射光の互いに異なる２つの直線偏光成分のうち、一方の直線偏光成分をほとんど吸収すること無く高い反射率で反射し、他方の直線偏光成分をほとんど吸収すること無く高い透過率で透過させるとともに、前記一対の反射偏光素子２１，２２の間に配置されたλ／２位相差板２３も、入射光をほとんど吸収すること無く高い透過率で透過させるため、一方と他方のいずれの面を表示面とするときも、充分な明るさの反射表示を行なうことができる。

【０１４３】
しかも、上記実施例では、前記反射手段２０ａの一対の反射偏光素子２１，２２を、それぞれの透過軸２１ａ，２２ａを実質的に平行にして配置し、その間に透過光の常光と異常光との間に１／２波長の位相差を与えるλ／２位相差板２３を配置しているため、前記一方の面を表示面とする反射表示のときに、前記第１の液晶表示素子１０Ａを透過して前記反射手段２０ａにその一方の面から入射した直線偏光Ｐのほとんどをこの反射手段２０ａにより反射するとともに、前記他方の面を表示面とする反射表示のときに、前記第２の液晶表示素子１０Ｂを透過して前記反射手段２０ａにその他方の面から入射した直線偏光Ｓのほとんどをこの反射手段２０ａにより反射することができ、したがって、一方と他方のいずれの面を表示面とするときも、その表示をより明るくすることができる。

【０１４４】
なお、この実施例の表示装置においても、前記反射手段２０ａは、入射光の大部分をその入射側とは反対側の反射偏光素子２２または２１による１回の反射で前記入射側に出射するとともに、一部の光を一対の反射偏光素子２１，２２の間で多重反射させ、その多重反射光を、前記１回の反射で出射する光の周囲から前記入射側に出射するため、明表示部からの光の出射面積を大きくし、前記明表示部を全体的に明るくするとともに、前記液晶表示素子１０Ａ，１０Ｂによる暗表示の影を無くし、二重像の無い良好な品質の反射表示を行なうことができる。

【０１４５】
また、この表示装置においても、前記反射手段２０ａを、一対の反射偏光素子２１，２２の間に面光源２４を配置した構成としているため、前記一方の面と他方の面の両方でそれぞれ、外光を利用する反射表示と、前記面光源２４からの照明光を利用する透過表示とを行なうことができる。

【０１４６】
なお、この実施例では、前記反射手段２０ａの一対の反射偏光素子２１，２２を、それぞれの透過軸２１ａ，２２ａを実質的に平行にして配置し、これらの反射偏光素子２１，２２の間にλ／２位相差板２３を配置しているが、前記一対の反射偏光素子２１，２２をそれぞれの透過軸２１ａ，２２ａを任意の角度で斜めに交差させて配置し、これらの反射偏光素子２１，２２の間に、一方の反射偏光素子を透過して入射した光の偏光状態を他方の反射偏光素子により反射される偏光状態に変化させる位相差をもった位相差板を配置して

もよい。

【０１４７】
また、前記一対の反射偏光素子２１，２２の透過軸２１ａ，２２ａの交差角と前記位相差板の位相差は、前記一対の反射偏光素子２１，２２の間で多重反射されて反射手段２０ａから出射する光を多くするように設定してもよく、その場合でも、前記反射手段２０ａの入射側とは反対側の反射偏光素子による１回の反射で出射する光を充分に確保できるようにすることにより、前記一方の面を表示面とする反射表示及び透過表示のときも、前記他方の面を表示面とする反射表示及び透過表示のときも、前記表示素子１０Ａ，１０Ｂによる入射光の遮断による暗表示と、透過光の反射による充分な明るさの明表示とを得ることができる。

【０１４８】
さらに、前記位相差板は、透過光に指向性をもたせるためのレンズシートを積層したものでもよく、このようなレンズシート積層位相差板を用いることにより、表示装置の前側に出射する光の正面輝度を高くし、より明るい表示を得ることができる。

【０１４９】
また、上記実施例では、前記反射手段２０ａを、第２の液晶表示素子１０Ｂ側の第２の反射偏光素子２２と面光源２４との間に位相差板２３を配置した構成としているが、前記位相差板２３は、第１の液晶表示素子１０Ａ側の第１の反射偏光素子２１と前記面光源２４との間に配置してもよい。

【０１５０】
さらに、上記実施例では、前記反射手段２０ａを、一対の反射偏光素子２１，２２の間に、位相差板２３と面光源２４とを配置した構成としているが、前記面光源２４の導光板を位相差板としてもよい。

【０１５１】
図８はこの発明の第３の実施例を示す表示装置の分解斜視図であり、この実施例は、それぞれの後面を互いに対向させて逆向きに配置された第１の液晶表示素子１０Ａと第２の液晶表示素子１０Ｂとの間に、一対の反射偏光素子２１，２２の間に、位相差板からなる導光板２７とその端面に端面に対向させて設けられた発光素子２６とからなる面光源２４ａを配置してなる反射手段２０ｂを配置したものである。

【０１５２】
なお、この実施例では、前記導光板２７を、透過光の常光と異常光との間に１／２波長の位相差を与えるλ／２位相差板とし、反射手段２０ｂの一対の反射偏光素子２１，２２を、それぞれの透過軸２１ａ，２２ａを実質的に互いに平行にして配置し、前記λ／２位相差板からなる導光板２７を、その遅相軸２７ａを前記反射偏光素子２１，２２のそれぞれの透過軸２１ａ，２２ａに対して実質的に４５°の角度で斜めにずらして配置している。

【０１５３】
この実施例の表示装置によれば、前記面光源２４ａの導光板２７を利用して、前記一対の反射偏光素子２１，２２の間を透過する光の偏光状態を変化させることができるため、上記第２の実施例のように、一対の反射偏光素子２１，２２の間に位相差板２３と面光源２４とを配置する場合に比べて、反射手段２０ｂの構成を簡単にし、薄型化することができる。

【０１５４】
また、上記第１～第３の実施例では、反射手段２０，２０ａ，２０ｂの一対の偏光分離素子を、反射偏光板からなる反射偏光素子２１，２２としているが、前記偏光分離素子は、入射光の互いに異なる２つの偏光成分のうち、一方の偏光成分を反射し、他方の偏光成分を透過させるものであれば、前記反射偏光板に限らない。

【０１５５】
図９は他の偏光分離素子の分解側面図であり、この偏光分離素子２８は、入射光の互いに直交する２つの直線偏光成分のうち、一方の偏光成分を反射し、他方の偏光成分を透過させる反射偏光素子である。以下、この偏光分離素子２８を反射偏光素子と言う。

【０１５６】
この反射偏光素子２８は、入射光の右回りと左回りの２つの円偏光成分のうち、一方の円偏光成分を反射し、他方の円偏光成分を透過させる円偏光分離層（例えばコレステリック液晶フィルム）２９を挟んで、入射する直線偏光を円偏光にして前記円偏光分離層２９に入射させ、前記円偏光分離層２９から出射した円偏光を直線偏光にして出射する一対の位相差板３０，３１を積層したものである。

【０１５７】
なお、前記一対の位相差板３０，３１はそれぞれ、透過光の常光と異常光との間に１／４波長の位相差を与えるλ／４位相差板であり、これらの位相差板３０，３１は、それぞれの遅相軸を実質的に互いに直交させて配置されている。

【０１５８】
この反射偏光素子２８は、前記一対のλ／４位相差板３０，３１の遅相軸に対して実質的に４５°ずれた互いに直交する２つの方向のうち、一方の方向、例えば図において上側の相差板（以下、上側位相差板と言う）３０の遅相軸に対し、上側（上側位相差板３０の外面側）から見て右回りに４５°ずれた方向に透過軸をもち、それと直交する他方の方向（下側相差板３１の遅相軸に対し、上側から見て左回りに４５°ずれた方向）に反射軸をもっており、入射光の入射光の互いに直交する２つの直線偏光成分のうち、前記反射軸に平行な振動面をもった一方の直線偏光成分を反射し、前記透過軸に平行な振動面をもった他方の直線偏光成分を透過させる。

【０１５９】
すなわち、この反射偏光素子２８は、その一方の面側、例えば図において上側から入射した光のうち、前記反射軸に平行な直線偏光Ｓを、前記上側位相差板３０により、光の進行方向（図において下方向）に向かって右回りの円偏光Ｒ１として前記円偏光分離層２９に入射させ、前記透過軸に平行な直線偏光Ｐを、前記上側位相差板３０により、光の進行方向に向かって左回りの円偏光Ｒ２として前記円偏光分離層２９に入射させるとともに、他方の面側、つまり図において下側から入射した光のうち、前記反射軸に平行な直線偏光Ｓを、前記下側位相差板３１により、光の進行方向（図において上方向）に向かって右回りの円偏光Ｒ１として前記円偏光分離層２９に入射させ、前記透過軸に平行な直線偏光Ｐを、前記下側位相差板３１により、光の進行方向に向かって左回りの円偏光Ｒ２として前記円偏光分離層２９に入射させる。

【０１６０】
なお、図９では便宜上、前記円偏光Ｒ１，Ｒ２の回転方向（矢印の向き）を、図において上側から見た方向に統一して示しているが、これらの円偏光Ｒ１，Ｒ２のうち、図において上側から下側に向かう円偏光Ｒ１，Ｒ２の進行方向に向かう方向から見た回転方向は図と同じ方向、図において下側から上側に向かう光の円偏光Ｒ１，Ｒ２の進行方向に向かう方向から見た回転方向は図とは逆の方向である。

【０１６１】
一方、円偏光分離層２９は、その一方と他方のいずれの面側から入射した光に対しても、その進行方向に向かって右回りの円偏光成分を反射し、左回りの円偏光成分を透過させる偏光分離特性を有している。

【０１６２】
そのため、図において上側から入射した光のうち、前記上側位相差板３０により進行方向に向かって右回りの円偏光Ｒ１とされて前記円偏光分離層２９に入射した光が、この円偏光分離層２９により反射され、その反射光Ｒ１が前記上側位相差板３０により前記反射軸に平行な直線偏光Ｓとされて上側に出射し、前記上側位相差板３０により進行方向に向かって左回りの円偏光Ｒ２とされて前記円偏光分離層２９に入射した光が、この円偏光分離層２９を透過して下側位相差板３１に入射し、この下側位相差板３１により前記透過軸に平行な直線偏光Ｐとされて下側に出射する。

【０１６３】
また、図において下側から入射した光のうち、前記下側位相差板３１により進行方向に向

出射して、前記反射手段２０ｃに入射する。

【０１７８】
前記反射手段２０ｃに入射した直線偏光Ｐは、この反射手段２０ｃの第１の偏光分離素子３２のλ／４位相差板３５により、進行方向に向かって左回りの円偏光Ｒ２とされて円偏光分離層３４に入射し、この円偏光分離層３４を透過して前記第１の偏光分離素子３２の後側に出射する。

【０１７９】
前記第１の偏光分離素子３２の後側に出射した左回りの円偏光Ｒ２は、面光源２４の導光板２５を透過して第２の偏光分離素子３３の偏光分離素子３３の円偏光分離層３４により反射され、その反射光Ｒ２が、前記面光源２４の導光板２５を再び透過して前記第１の偏光分離素子３２にその後側から再入射する。

【０１８０】
前記第１の偏光分離素子３２にその後側から再入射した前記円偏光Ｒ２は、この第１の偏光分離素子３２の円偏光分離層３４を透過し、さらにλ／４位相差板３５により直線偏光Ｐとされて第１の液晶表示素子１０Ａ側に出射し、前記第１の液晶表示素子１０Ａを再び透過してその前側に出射する。

【０１８１】
一方、前記第１の液晶表示素子１０Ａの液晶セル１１の電極間に液晶分子を基板３，４面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図１１（ａ）の右側に示したように、第１の液晶表示素子１０Ａの前側から入射し、その前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｓが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前記液晶セル１１を透過して後側の吸収偏光板１７に入射し、その光のほとんどが前記後側の吸収偏光板１７により吸収される。

【０１８２】
したがって、前記一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする反射表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【０１８３】
また、前記一方の面を表示面とする透過表示のときは、前記反射手段２０ｃの面光源２４の発光素子２６が点灯され、前記発光素子２６からの出射光が、図１１（ｂ）のように、導光板２５の一方と他方の面から出射する。

【０１８４】
そして、前記導光板２５の第１の偏光分離素子３２に対向する面から出射した照明光は、前記第１の偏光分離素子３２の円偏光分離層３４に入射し、その光（非偏光）のうち、進行方向に向かって右回りの円偏光成分が前記円偏光分離層３４により反射され、左回りの円偏光成分が、前記円偏光分離層３４を透過する。この円偏光分離層３４を透過した左回りの円偏光Ｒ２は、λ／４位相差板３５により直線偏光Ｐとされて第１の液晶表示素子１０Ａ側に出射する。

【０１８５】
一方、前記導光板２５の第１の偏光分離素子３２に対向する面から出射した光のうち、前記第１の偏光分離素子３２の円偏光分離層３４により反射された右回りの円偏光Ｒ１は、前記導光板２５を透過し、さらに第２の偏光分離素子３３の円偏光分離層３４を透過するとともにλ／４位相差板３５により直線偏光Ｓとされて第２の液晶表示素子１０Ｂ側に出射する。

【０１８６】
また、前記導光板２５の第２の偏光分離素子３３に対向する面から出射した照明光は、前記第２の偏光分離素子３３の円偏光分離層３４に入射し、その光（非偏光）のうち、進行方向に向かって左回りの円偏光成分が前記円偏光分離層３４により反射され、右回りの円偏光成分が、前記円偏光分離層３４を透過する。この円偏光分離層３４を透過した右回りの円偏光Ｒ１は、λ／４位相差板３５により直線偏光Ｓとされて第２の液晶表示素子１０

Ｂ側に出射する。

【０１８７】

一方、前記導光板２５の第２の偏光分離素子３３に対向する面から出射した光のうち、前記第２の偏光分離素子３３の円偏光分離層３４により反射された左回りの円偏光Ｒ２は、前記導光板２５を透過し、さらに第１の偏光分離素子３２の円偏光分離層３４を透過するとともにλ／４位相差板３５により直線偏光Ｐとされて第１の液晶表示素子１０Ａ側に出射する。

【０１８８】

すなわち、前記反射手段２０ｃは、前記面光源２４からの照明光を互いに直交する略同じ強度の２つの直線偏光Ｐ，Ｓに分離し、一方の直線偏光Ｐを第１の液晶表示素子１０Ａ側に出射し、他方の直線偏光Ｓを第２の液晶表示素子１０Ｂ側に出射する。

【０１８９】

そして、前記反射手段２０ｃから第１の液晶表示素子１０Ａ側に出射した直線偏光Ｐは、この第１の液晶表示素子１０Ａの後側の吸収偏光板１７を透過して液晶セル１１にその後側から入射し、前記液晶セル１１の電極間に印加される電界により変化する液晶分子の配向状態に応じた液晶層１５の複屈折作用を受けてこの液晶セル１１の前側に出射する。

【０１９０】

すなわち、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図１１（ｂ）の左側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｐが、液晶層１５の複屈折作用により実質的に９０°旋光して直線偏光Ｓとなり、その直線偏光Ｓが前側の吸収偏光板１６を透過して前記第１の液晶表示素子１０Ａの前側に出射する。

【０１９１】

一方、前記第１の液晶表示素子１０Ａの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図１１（ｂ）の右側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｐが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前側の吸収偏光板１６に入射し、その光のほとんどが前記前側の吸収偏光板１６により吸収される。

【０１９２】

したがって、前記一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする透過表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【０１９３】

次に、他方の面を表示面とするときの入射光の透過経路を説明すると、図１２（ａ）は他方の面を表示面とする反射表示のときの入射光の透過経路を示し、図１２（ｂ）は他方の面を表示面とする透過表示のときの入射光の透過経路を示している。

【０１９４】

前記他方の面を表示面とする反射表示のときは、図１２（ａ）のように、第２の液晶表示素子１０Ｂにその前側から入射した外光（非偏光）が、この第２の液晶表示素子１０Ｂの前側の吸収偏光板１６により、その透過軸１６ａに平行な直線偏光Ｐとされて液晶セル１１に入射する。

【０１９５】

そして、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図１２（ａ）の左側に示したように、前記前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｐが、実質的に９０°旋光して直線偏光Ｓとなり、その直線偏光Ｓが、後側の吸収偏光板１７を透過して前記第２の液晶表示素子１０Ｂの後側に出射する。

【０１９６】

前記第２の液晶表示素子１０Ｂの後側に出射した前記直線偏光Ｓは、前記反射手段２０ｃに入射し、この反射手段２０ｃの第２の偏光分離素子３３のλ／４位相差板３５により、進行方向に向かって右回りの円偏光Ｒ１とされて円偏光分離層３４に入射し、この円偏光分離層３４を透過して前記第２の偏光分離素子３３の後側に出射する。

【０１９７】
前記第２の偏光分離素子３３の後側に出射した右回りの円偏光Ｒ１は、面光源２４の導光板２５を透過して第１の偏光分離素子３２の円偏光分離層３４により反射され、その反射光Ｒ１が、前記面光源２４の導光板２５を再び透過して前記第２の偏光分離素子３３にその後側から再入射する。

【０１９８】
前記第２の偏光分離素子３３にその後側から再入射した前記円偏光Ｒ１は、この第２の偏光分離素子３３の円偏光分離層３４を透過し、さらにλ／４位相差板３５により、前記第２の液晶表示素子１０Ｂの後側に出射して反射手段２０ｃに入射した光と同じ直線偏光Ｐに戻されて第１の液晶表示素子１０Ａ側に出射し、前記第１の液晶表示素子１０Ａを再び透過してその前側に出射する。

【０１９９】
一方、前記第２の液晶表示素子１０Ｂの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図１２（ａ）の右側に示したように、第２の液晶表示素子１０Ｂの前側から入射し、その前側の吸収偏光板１６を透過して液晶セル１１に入射した直線偏光Ｓが、液晶層１５の複屈折作用を受けずにその偏光状態のまま後側の吸収偏光板１７に入射し、この吸収偏光板１７により吸収される。

【０２００】
したがって、前記他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする反射表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【０２０１】
また、前記他方の面を表示面とする透過表示のときは、上述した一方の面を表示面とする透過表示のときと同様に、前記反射手段２０ｃの面光源２４の発光素子２６が点灯され、前記反射手段２０ｃから第１の液晶表示素子１０Ａ側に直線偏光Ｐが出射し、第２の液晶表示素子１０Ｂ側に直線偏光Ｓが出射する。

【０２０２】
そして、前記反射手段２０ｃから第２の液晶表示素子１０Ｂ側に出射した直線偏光Ｓは、この第２の液晶表示素子１０Ｂの後側の吸収偏光板１７を透過して液晶セル１１にその後側から入射し、前記液晶セル１１の電極間に印加される電界により変化する液晶分子の配向状態に応じた液晶層１５の複屈折作用を受けてこの液晶セル１１の前側に出射する。

【０２０３】
すなわち、前記液晶セル１１の電極間に電界を印加しない無電界時（Ｖ＝０）は、図１２（ｂ）の左側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｓが、液晶層１５により実質的に９０°旋光し、前側の吸収偏光板１６の透過軸１６ａに平行な直線偏光Ｐとなって液晶セル１１の前側に出射し、前側の吸収偏光板１６を透過して前記第２の液晶表示素子１０Ｂの前側に出射する。

【０２０４】
一方、前記第２の液晶表示素子１０Ｂの液晶セル１１の電極間に液晶分子を基板１２，１３面に対して実質的に垂直に立上がり配向させる電界を印加した電界印加時（Ｖ＞Ｖｔｈ）は、図１２（ｂ）の右側に示したように、前記液晶セル１１にその後側から入射した直線偏光Ｓが、液晶層１５の複屈折作用を受けずにその偏光状態のまま前記液晶セル１１を透過して前側の吸収偏光板１６に入射し、この吸収偏光板１６により吸収される。

【０２０５】
したがって、前記他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする透過表示のときの無電界時の表示は明表示（着色表示）であり、電界印加時（Ｖ＞Ｖｔｈ）の表示は暗表示（黒表示）である。

【０２０６】
このように、この実施例の表示装置は、第１と第２の液晶表示素子１０Ａ，１０Ｂの間に

、入射光の右回りと左回りの２つの円偏光成分のうち、一方の円偏光成分を反射し、他方の円偏光成分を透過させる円偏光分離層３４と、前記円偏光分離層３４の一方の面側に配置され、前記円偏光分離層３４に対向する面とは反対面から入射した直線偏光を円偏光にして前記円偏光分離層３４に入射させ、前記円偏光分離層３４から出射した円偏光を直線偏光にして前記反対面から出射するλ／３位相差板３５とからなる一対の偏光分離素子３２，３３をそれぞれの円偏光分離層３４を互いに向き合わせて配置した反射手段２０ａを配置することにより、一方の面（第１の液晶表示素子１０Ａの前面）を表示面とする反射表示のときは、前記第１の液晶表示素子１０Ａの前側から入射してこの第１の液晶表示素子１０Ａを透過した光を、前記反射手段２０ｃの第１の液晶表示素子１０Ａ側の偏光分離素子３２を透過させて第２の液晶表示素子１０Ｂ側の偏光分離素子３３により反射し、他方の面（第２の液晶表示素子１０Ｂの前面）を表示面とする反射表示のときは、前記第２の液晶表示素子１０Ｂの前側から入射してこの第２の液晶表示素子１０Ｂを透過した光を、前記反射手段２０ａの第２の液晶表示素子１０Ｂ側の偏光分離素子３３を透過させて第１の液晶表示素子１０Ａ側の偏光分離素子３２により反射するようにしたものである。

【０２０７】

この表示装置によれば、前記反射手段２０ａの一対の偏光分離素子３２，２２がそれぞれ、入射光の互いに異なる２つの偏光成分のうち、一方の偏光成分をほとんど吸収すること無く高い反射率で反射し、他方の偏光成分をほとんど吸収すること無く高い透過率で透過させるため、一方と他方のいずれの面を表示面とするときも、充分な明るさの反射表示を行なうことができる。

【０２０８】

しかも、この実施例の表示装置では、前記反射手段２０ｃの一対の偏光分離素子３２，２２のうち、一方の偏光分離素子３２の円偏光分離層３４が、右回りの円偏光成分を反射し、左回りの円偏光成分を透過させる偏光分離特性を有し、他方の偏光分離素子３３の円偏光分離層３４が、左回りの円偏光成分を反射し、右回りの円偏光成分を透過させる偏光分離特性を有しているため、前記一方の面を表示面とする反射表示のときに、前記第１の液晶表示素子１０Ａを透過して前記反射手段２０ｃにその一方の面から入射した光のほとんどをこの反射手段２０ｃにより反射するとともに、前記他方の面を表示面とする反射表示のときに、前記第２の液晶表示素子１０Ｂを透過して前記反射手段２０ｃにその他方の面から入射した光のほとんどをこの反射手段２０ｃにより反射することができ、したがって、一方と他方のいずれの面を表示面とするときも、その表示をより明るくすることができる。

【０２０９】

なお、この実施例の表示装置においても、前記反射手段２０ｃは、入射光の大部分をその入射側とは反対側の偏光分離素子３３または３２による１回の反射で前記入射側に出射するとともに、一部の光を一対の偏光分離素子３２，２２の間で多重反射させ、その多重反射光を、前記１回の反射で出射する光の周囲から前記入射側に出射するため、明表示部からの光の出射面積を大きくし、前記明表示部を全体的に明るくするとともに、前記液晶表示素子１０Ａ，１０Ｂによる暗表示の影を無くし、二重像の無い良好な品質の反射表示を行なうことができる。

【０２１０】

また、この表示装置においても、前記反射手段２０ａを、一対の偏光分離素子３２，２２の間に面光源２４を配置した構成としているため、前記一方の面と他方の面の両方でそれぞれ、外光を利用する反射表示と、前記面光源２４からの照明光を利用する透過表示とを行なうことができる。

【０２１１】

なお、上述した第１～第４の実施例の表示装置は、一方の面を表示面とする表示と、他方の面を表示面とする表示の両方をノーマリーホワイトモードとしたものであるが、この発明は、前記一方の面を表示面とする表示と、前記他方の面を表示面とする表示の一方または両方を、無電界時の表示が暗表示であるノーマリーブラックモードとした表示装置にも

適用できる。

【０２１２】

また、上記各実施例の表示装置は、第１と第２の表示素子１０Ａ，１０ＢをそれぞれＴＮ型の液晶表示素子としたものであるが、前記表示素子１０Ａ，１０Ｂは、ＴＮ型に限らず、ＳＴＮ型、非ツイストのホモジニアス配向型、ホメオトロピック配向型、横電界型、強誘電または反強誘電型、ＥＣＢ（複屈折効果）型等の液晶表示素子でもよく、また、前記第１と第２の表示素子１０Ａ，１０Ｂの一方と他方を異なる型の液晶表示素子としてもよい。

【０２１３】

また、前記第１と第２の表示素子１０Ａ，１０Ｂは、その一方または両方を、カラーフィルタを備えないモノクロ表示素子としてもよく、その場合は、両方の表示素子１０Ａ，１０Ｂをモノクロ表示素子とし、透過表示のときに、前記表示素子１０Ａ，１０Ｂに赤、緑、青の単色画像データを順次書込むとともに、反射手段２０，２０ａ，２０ｂ，２０ｃから赤、緑、青の着色光を順次出射するフィールドシーケンシャル表示を行なうようにしてもよい。

【０２１４】

さらに、前記第１と第２の表示素子１０Ａ，１０Ｂは、入射光の透過と遮断を制御するものであれば、液晶表示素子以外の表示素子でもよい。

【０２１５】

また、上記各実施例の表示装置は、反射手段２０，２０ａ，２０ｂ，２０ｃに面光源２４，２４ａを備えさせ、一方の面を表示面とするときも、他方の面を表示面とするときも、外光を利用する反射表示と、前記面光源２４，２４ａからの照明光を利用する透過表示との両方の表示を行なえるようにしたものであるが、前記反射手段２０，２０ａ，２０ｂ，２０ｃから面光源２４，２４ａを省略し、一方の面を表示面とする表示と、他方の面を表示面とする表示とを反射表示だけにしてもよい。

【０２１６】

【発明の効果】

この発明の表示装置は、表示の観察側である前側から入射した光の透過と遮断を制御する第１と第２の表示素子を、それぞれの後面を互いに対向させて逆向きに配置し、前記第１と第２の表示素子の間に、入射光の互いに異なる２つの偏光成分のうち、一方の偏光成分を反射し、他方の偏光成分を透過させる一対の偏光分離素子を有し、その一方の偏光分離素子を透過した偏光成分の光を他方の偏光分離素子により反射し、前記他方の偏光分離素子を透過した偏光成分の光を前記一方の反射偏光素子により反射する反射手段を配置したものであるため、一方と他方のいずれの面を表示面とするときも、充分な明るさの反射表示を行なうことができる。

【０２１７】

この発明の表示装置において、前記反射手段の一対の反射偏光素子は、それぞれの透過軸を互いに交差させて配置するのが好ましく、このようにすることにより、一方の面（第１の表示素子の前面）を表示面とする反射表示のときに、第１の表示素子を透過し、この第１の表示素子側の反射偏光素子を透過した光を、前記反射手段により反射して前記第１の表示素子の前側に出射するとともに、他方の面（第２の表示素子の前面）を表示面とする反射表示のときに、第２の表示素子を透過し、この第２の表示素子側の反射偏光素子を透過した光を、前記反射手段により反射して前記第２の表示素子の前側に出射して、前記一方の面を表示面とする反射表示のときも、前記他方の面を表示面とする反射表示のときも、透過光の反射による充分な明るさの表示を得ることができる。

【０２１８】

この発明の表示装置において、前記反射手段の一対の偏光分離素子はそれぞれ、互いに直交する方向に透過軸と反射軸とをもち、入射光の互いに直交する２つの直線偏光成分のうち、前記反射軸に平行な振動面をもった一方の直線偏光成分を反射し、前記透過軸に平行な振動面をもった他方の直線偏光成分を透過させる反射偏光素子が望ましく、その場合、

前記反射手段を、前記一対の反射偏光素子をそれぞれの透過軸を互いに交差させて配置するか、あるいは、前記一対の反射偏光素子の間に、透過光の偏光状態を変化させる位相差板をさらに配置した構成とすることにより、一方の面を表示面とする反射表示のときも、他方の面を表示面とする反射表示のときも、充分な明るさの表示を得ることができる。

【０２１９】

また、この発明の表示装置において、前記第１と第２の表示素子を、表示の観察側である前側の基板と、この前側基板に対向する後側基板との間に、印加される電界に応じて透過光の偏光状態を制御する液晶層が設けられた液晶セルを挟んでその前後に、互いに直交する方向に透過軸と吸収軸とをもち、入射光の互いに直交する２つの直線偏光成分のうち、前記吸収軸に平行な一方の偏光成分の光を吸収し、前記透過軸に平行な他方の偏光成分を透過させる一対の吸収偏光板が配置された液晶表示素子とする場合、前記反射手段の一対の反射偏光素子のうち、前記第１の液晶表示素子側の反射偏光素子は、その透過軸を前記第１の液晶表示素子の後側の吸収偏光板の透過軸と実質的に平行にして配置し、前記第２の液晶表示素子側の反射偏光素子は、その透過軸を前記第２の表示素子の後側の吸収偏光板の透過軸と実質的に平行にして配置するのが望ましく、このようにすることにより、一方の面を表示面とする反射表示のときも、他方の面を表示面とする反射表示のときも、その表示をより明るくすることができる。

【０２２０】

さらに、この発明の表示装置において、前記反射手段は、入射光の右回りと左回りの２つの円偏光成分のうち、一方の円偏光成分を反射し、他方の円偏光成分を透過させる円偏光分離層と、前記円偏光分離層の一方の面側に配置され、前記円偏光分離層に対向する面とは反対面から入射した直線偏光を円偏光にして前記円偏光分離層に入射させ、前記円偏光分離層から出射した円偏光を直線偏光にして前記反対面から出射する位相差板とからなる一対の偏光分離素子を有し、これらの偏光分離素子を、それぞれの前記円偏光分離層を互いに向き合わせて配置した構成としてもよく、このような構成とすることにより、一方の面を表示面とする反射表示のときも、他方の面を表示面とする反射表示のときも、充分な明るさの表示を得ることができる。

【０２２１】

また、この発明の表示装置において、前記反射手段は、前記一対の偏光分離素子の間に、一方と他方の面から入射した光をそれぞれ透過させ、端面からの入射光を前記一方と他方の少なくとも一方の面から出射する導光板と、この導光板の前記端面に対向させて設けられた発光素子とからなる面光源をさらに配置した構成とするのが望ましく、このようにすることにより、前記一方の面と他方の面の両方でそれぞれ、外光を利用する反射表示と、前記面光源からの照明光を利用する透過表示とを行なうことができる。

【図面の簡単な説明】

【図１】この発明の第１の実施例を示す表示装置の分解斜視図。

【図２】第１の実施例の表示装置の一方の面を表示面とするときの入射光の透過経路を示す模式図。

【図３】第１の実施例の表示装置の他方の面を表示面とするときの入射光の透過経路を示す模式図。

【図４】両面に表示部をもった電子機器の一例を示す斜視図。

【図５】この発明の第２の実施例を示す表示装置の分解斜視図。

【図６】第２の実施例の表示装置の一方の面を表示面とするときの入射光の透過経路を示す模式図。

【図７】第２の実施例の表示装置の他方の面を表示面とするときの入射光の透過経路を示す模式図。

【図８】この発明の第３の実施例を示す表示装置の分解斜視図。

【図９】他の偏光分離素子の分解側面図。

【図１０】この発明の第４の実施例を示す表示装置の分解斜視図。

【図１１】第４の実施例の表示装置の一方の面を表示面とするときの入射光の透過経路を

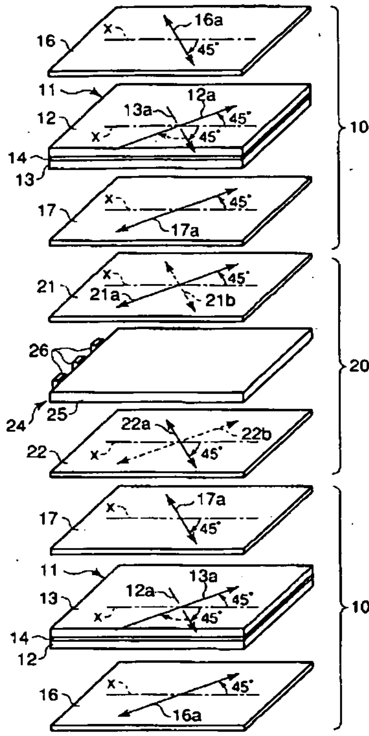
示す模式図。

【図１２】第４の実施例の表示装置の他方の面を表示面とするときの入射光の透過経路を示す模式図。

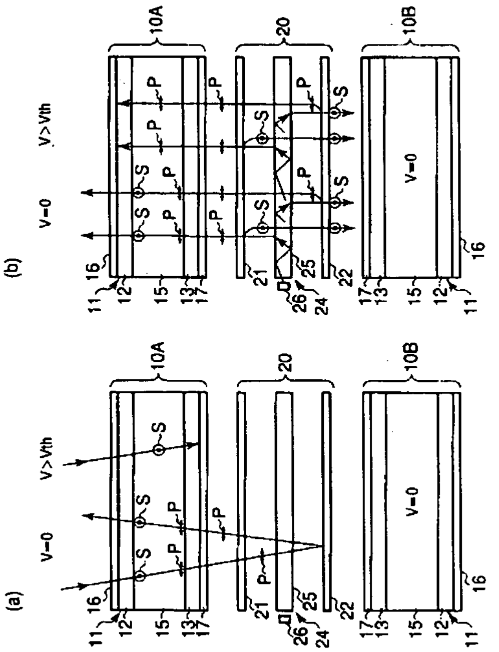
【符号の説明】

１０Ａ，１０Ｂ…液晶表示素子
１１…液晶セル
１５…液晶層
１６，１７…吸収偏光板
１６ａ，１７ａ…透過軸
２０，２０ａ，２０ｂ，２０ｃ…反射手段
２１，２２…反射偏光素子（偏光分離素子）
２１ａ，２２ａ…透過軸
２１ｂ，２２ｂ…反射軸
２３…λ／２位相差板
２３ａ…遅相軸
２４…面光源
２５…導光板
２６…発光素子
２７…位相差板からなる導光板
２７ａ…遅相軸
２８…反射偏光素子（偏光分離素子）
２９…円偏光分離層
３０，３１…λ／４位相差板
３２，３３…偏光分離素子
３４…円偏光分離層
３５…λ／４位相差板
３５ａ…遅相軸

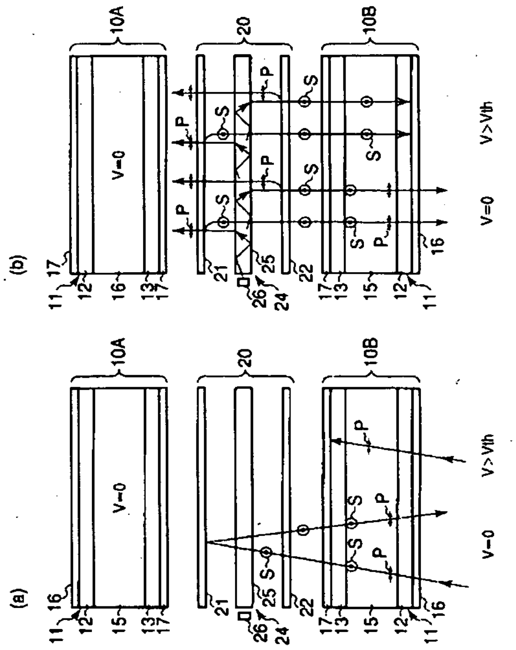
【図１】


x
45°
45°
x
45°
x
45°
x
45°
x
45°
x
45°
45°
x
45°
x
45°

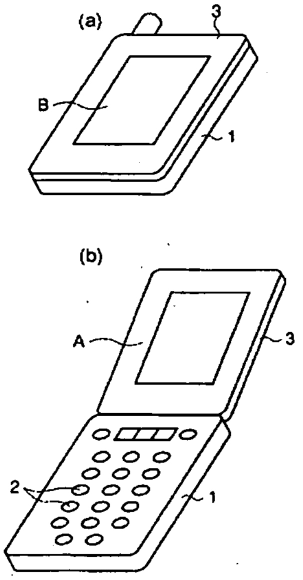
【図２】


(b)
V>Vth
V=0
P
S
V=0
(a)
V>Vth
V=0
S
P
V=0

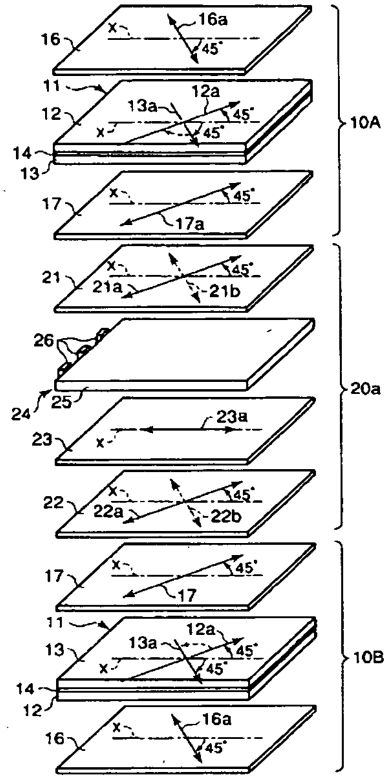
【図３】


(b)
V=0
P
S
V>Vth
V=0
(a)
V=0
P
S
V>Vth
V=0

【図４】


(a)
3
B
1
(b)
A
3
2
1

【図５】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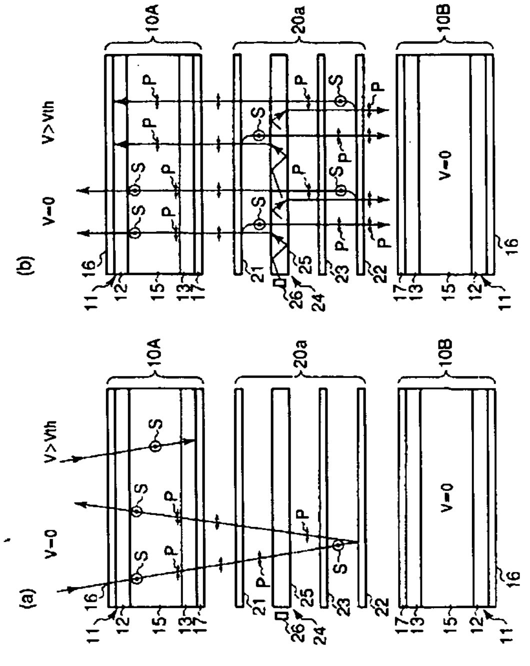
x
45°

【図６】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P
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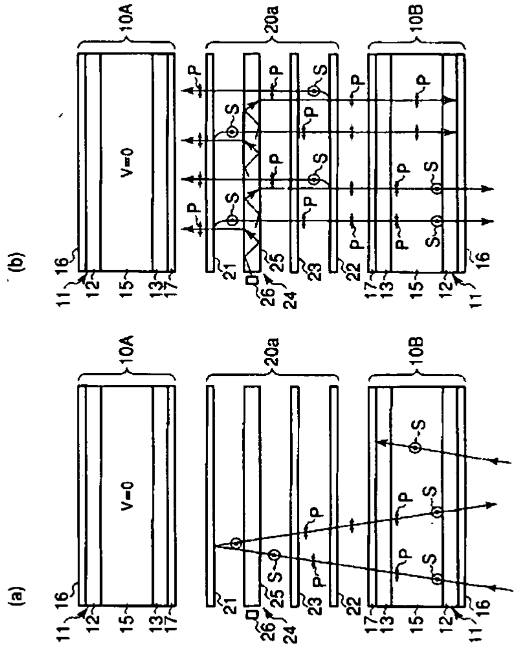
【図７】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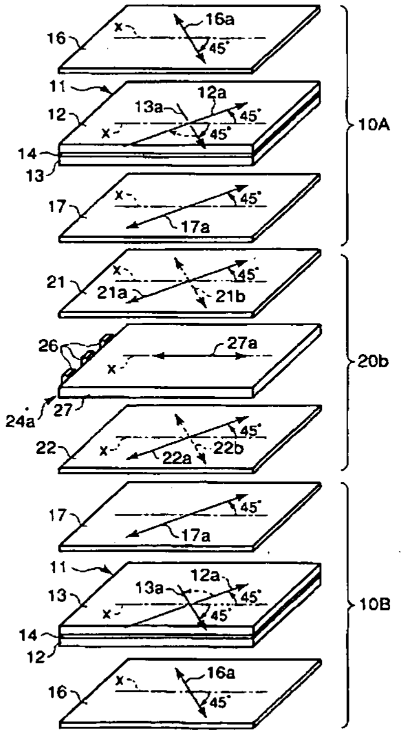
P
S
(a)
V=0
P
S

【図８】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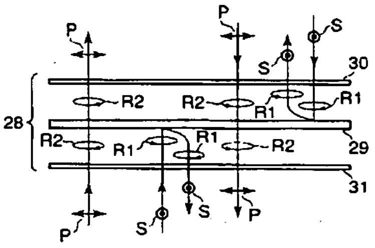
x
45°

【図９】



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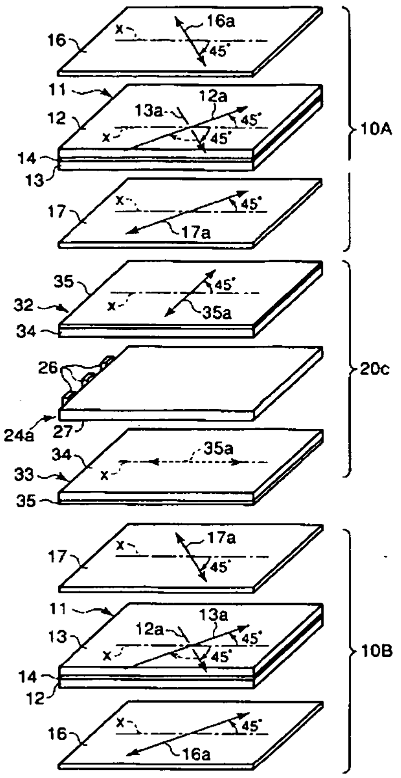

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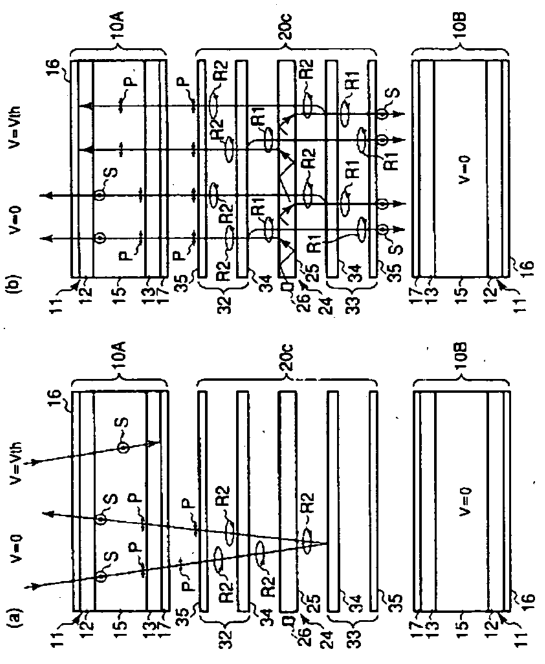
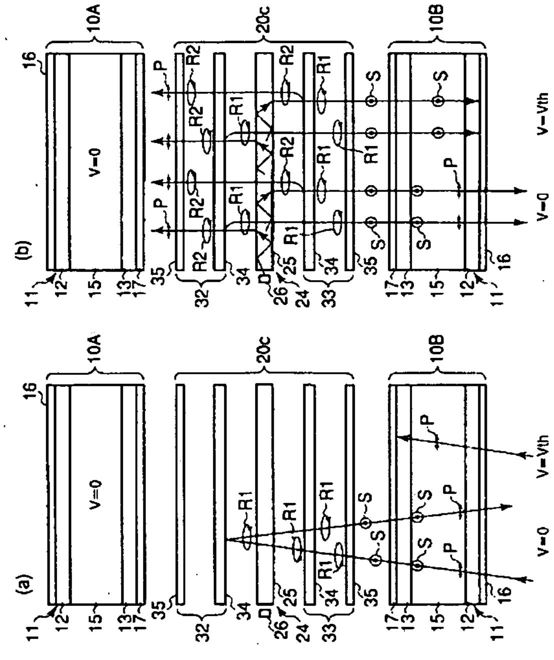


【図１２】



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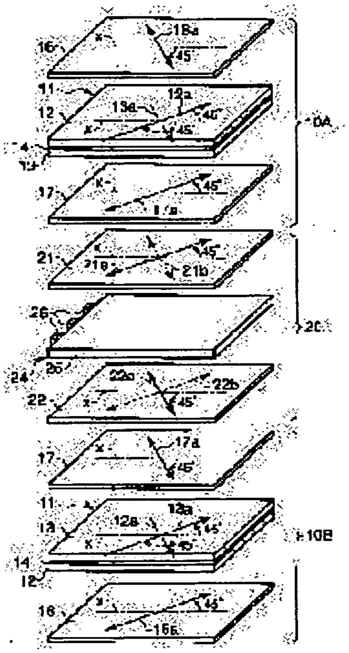
(54) DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a double-sided display type display device capable of performing satisfactory luminous reflection display even when either surface of one or the other is used as a display surface.

SOLUTION: First and second display elements 10A and 10B controlling transmission and interception of light made incident from the front sides to be the viewer sides of display are disposed in reverse directions by making respective rear surfaces to face each other. A reflection means 20 having a pair of polarization separation elements 21 and 22 reflecting one polarized light component of two polarized light components of incident light different from each other and transmitting the other polarized light component, reflecting light of the polarized light component transmitted through the one polarization separation element 21 by the other polarization separation element 22 and reflecting light of the polarized light component transmitted through the other polarization separation element 22 by the one polarization separation element 21 is disposed between the display elements 10A and 10B.



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[Date of requesting appeal against examiner's decision of rejection]	
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CLAIMS

[Claim(s)]

[Claim 1]

The 1st and the 2nd display device which control transparency and cutoff of the light which carried out incidence from the side before the observation side of a display made the rear face which is a field of the opposite side counter mutually, has been arranged at the reverse sense and was an observation side of a display, respectively,

One polarization component is reflected between two polarization components different mutually [incident light], and it has the polarization separation component of the pair which makes the polarization component of another side penetrate. Between said the 1st and 2nd display device One side of the polarization separation component of said pair is made to counter the rear face of said 1st display device. A reflective means to make another side counter the rear face of said 2nd display device, to be arranged, to reflect the light of the polarization component which penetrated one [said] polarization separation component by the polarization separation component of another side, and to reflect the light of the polarization component which penetrated the polarization separation component of said another side by one [said] reflective polarizing element,

The display characterized by preparation ******.

[Claim 2]

The polarization separation component of the pair of a reflective means is the display according to claim 1 characterized by to be the reflective polarizing element which makes the linearly polarized light component of another side in which the linearly polarized light component was reflected in and while it had a transparency shaft and a reflective shaft in the direction which intersects perpendicularly mutually, respectively and had a plane of vibration parallel to said reflective shaft between two linearly polarized light components which intersect perpendicularly mutually [incident light] had a plane of vibration parallel to said transparency shaft penetrate.

[Claim 3]

The reflective polarizing element of a pair is a display according to claim 2 characterized by making each transparency shaft cross mutually substantially, and being arranged.

[Claim 4]

A reflective means is a display according to claim 2 characterized by having further the phase contrast plate to which it is arranged between the reflective polarizing elements of a pair, and the polarization condition of the transmitted light is changed.

[Claim 5]

After the 1st and the 2nd display device counter a near substrate and a before [this] side substrate before being the observation sides of a display, between side substrates The liquid crystal cell in which the liquid crystal layer which controls the polarization condition of the transmitted light according to the electric field impressed was prepared is pinched. Before and after that The inside of two linearly polarized light components which have a transparency shaft and an absorption shaft in the direction which intersects perpendicularly mutually, and intersect perpendicularly mutually [incident light], It is the liquid crystal display component by which the absorption polarizing plate of the pair which makes the

polarization component of another side in which the polarization component was absorbed and while it had a plane of vibration parallel to said absorption shaft had a plane of vibration parallel to said transparency shaft penetrate has been arranged,
The reflective polarizing element by the side of the 1st liquid crystal display component among the reflective polarizing elements of the pair of a reflective means Set substantially the transparency shaft of the absorption polarizing plate on the backside [said 1st liquid crystal display component] as the transparency shaft at parallel, and it is arranged. The display according to claim 3 characterized by for the reflective polarizing element by the side of the 2nd liquid crystal display component setting substantially the transparency shaft of the absorption polarizing plate on the backside [said 2nd liquid crystal display component] as the transparency shaft at parallel, and arranging it.
[Claim 6]
The circular polarization of light detached core which the polarization separation component of the pair of a reflective means reflects [detached core] one circular polarization of light component between two circular polarization of light components of the right-handed rotation and left-handed rotation of incident light, respectively, and makes the circular polarization of light component of another side penetrate, It is arranged at one field side of said circular polarization of light detached core, make into the circular polarization of light the linearly polarized light which carried out incidence to the field which counters said circular polarization of light detached core from the opposite side, and incidence is carried out to said circular polarization of light detached core. The display according to claim 1 characterized by consisting of a phase contrast plate which makes the circular polarization of light which carried out outgoing radiation from said circular polarization of light detached core the linearly polarized light, and carries out outgoing radiation from said opposite side, and for these polarization separation components opposing mutually said each circular polarization of light detached core, and being arranged.
[Claim 7]
The light guide plate which a reflective means is arranged between the polarization separation components of a pair, is made to penetrate the light which carried out incidence from the field of one side and another side, respectively, and carries out outgoing radiation of the incident light from an end face from one [at least] field of said one side and another side, The display according to claim 1 to 6 characterized by having further the surface light source which consists of a light emitting device which was made to counter said end face of this light guide plate, and was prepared.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]

This invention relates to the display which performs a reflective display in both sides.

[0002]

[Description of the Prior Art]

Recently, as electronic equipment, such as a portable telephone which has the lid which can be opened and closed to the body of a device, and a personal digital assistant machine, also in the condition which opened the lid, or the condition of having closed, what prepared the display in the inside (field which counters the body of a device when a lid is closed) of said lid, and external surface, respectively is increasingly seen so that information can be displayed.

[0003]

The display of the double-sided display mold which each rear face (the observation side of a display is the field of the opposite side) was made to counter mutually, and has arranged two display devices which control transparency and cutoff of the light which carried out incidence from the side, the 1st and the 2nd, to the reverse sense before being the observation side of a display, and has arranged the surface light source called a back light among these display devices is used for this kind of electronic equipment (patent reference 1, 2 reference).

[0004]

Although this double-sided display mold display gives a double-sided indication to the transparency display using the light from said surface light source, respectively, it is also possible by arranging a reflecting plate between said two display devices to consider as the reflective display using the outdoor daylight which is the light of an external environment about a double-sided display, respectively.

[0005]

In said two display devices of said double-sided display mold display After countering a near substrate and a before [this] side substrate generally before being the observation side of a display, between side substrates The liquid crystal cell in which the liquid crystal layer which controls the polarization condition of the transmitted light according to the electric field impressed was prepared is pinched. Before and after that The inside of two linearly polarized light components which have a transparency shaft and an absorption shaft in the direction which intersects perpendicularly mutually, and intersect perpendicularly mutually [incident light], The liquid crystal display component by which the absorption polarizing plate of the pair which makes the polarization component of another side in which the polarization component was absorbed and while it had a plane of vibration parallel to said absorption shaft had a plane of vibration parallel to said transparency shaft penetrate has been arranged uses, and it is ********.

[0006]

In addition, the inside of two polarization components which intersect perpendicularly mutually the polarizing plate by the side of after that with a liquid crystal display component, There are some which were used as the dispersion polarizing plate which is made to penetrate one polarization component, and the polarization component of another side is scattered and is made to reflect or penetrate. This liquid crystal display component A light absorption layer or a reflecting plate is arranged, and it is made to perform a reflective display to an after that side, or is used for the display of the one side display mold which arranges the surface light source further and was made to display both the reflective display and the transparency display on the backside [said dispersion polarizing plate] (patent reference 3 reference).

[0007]

[Patent reference 1]

JP,10-90678,A

[0008]

[Patent reference 2]

JP,2001-290445,A

[0009]

[Patent reference 3]
JP,2000-75284,A
[0010]
[Problem(s) to be Solved by the Invention]
However, the double-sided display mold display which was made to perform the reflective display which arranges a reflecting plate and uses outdoor daylight between two display devices as mentioned above In order to absorb a part of the light with said reflecting plate in case the light which carried out incidence from the before [the screen] side, and penetrated the display device by the side of said screen is reflected by the reflecting plate which consists of a metal membrane also when making which field of the one side and another side into the screen, The display of both fields has the problem of being dark.
[0011]
This invention aims at offering the display of the double-sided display mold which can perform the reflective display of sufficient brightness, also when making which field of one side and another side into the screen.
[0012]
[Means for Solving the Problem]
The 1st and the 2nd display device by which the observation side of a display makes the rear face which is a field of the opposite side counter mutually, and the display of this invention is arranged at the reverse sense, and controls transparency and cutoff of the light which carried out incidence from the side before being the observation side of a display, respectively, One polarization component is reflected between two polarization components different mutually [incident light], and it has the polarization separation component of the pair which makes the polarization component of another side penetrate. Between said the 1st and 2nd display device One side of the polarization separation component of said pair is made to counter the rear face of said 1st display device. Make another side counter the rear face of said 2nd display device, it is arranged, and the light of the polarization component which penetrated one [said] polarization separation component is reflected by the polarization separation component of another side. It is characterized by having a reflective means to reflect the light of the polarization component which penetrated the polarization separation component of said another side by one [said] reflective polarizing element.
[0013]
When this display performs the reflective display which makes one screen the front face of said 1st display device, and the reflective display which makes the front face of said 2nd display device the screen of another side and said 1st display device makes one field the screen It drives so that transparency and cutoff of incident light may be controlled, and when making the field of another side into the screen, said 2nd display device is driven so that transparency and cutoff of incident light may be controlled.
[0014]
At and the time of the reflective display which makes the screen one [said] field, i.e., the front face of the 1st display device While the light which carried out incidence from the before [said 1st display device] side has transparency and cutoff controlled by this 1st display device and a dark display is obtained by that cutoff The light which penetrated said 1st display device penetrates one polarization separation component by the side of the 1st [of said reflective means] display device, and is reflected by the polarization separation component of another side. The reflected light penetrates one [said] polarization separation component again, said 1st display device is penetrated further, outgoing radiation is carried out to the before side, and clear display is obtained.
[0015]
At moreover, the time of the reflective display which makes the screen the field of said another side, i.e., the front face of the 2nd display device While the light which carried out incidence from the before

[said 2nd display device] side has transparency and cutoff controlled by this 2nd display device and a dark display is obtained by that cutoff The light which penetrated said 2nd display device penetrates the polarization separation component of said another side of said reflective means, and is reflected by one [said] polarization separation component, the reflected light penetrates the polarization separation component of said another side again, said 2nd display device is penetrated further, outgoing radiation is carried out to the before side, and clear display is obtained.

[0016]

At namely, the time of the reflective display whose display of this makes the screen the field (front face of the 1st display device) of one of these The light which carried out incidence from the before [said 1st display device] side, and penetrated this 1st display device Make the polarization separation component by the side of the 1st [of said reflective means] display device penetrate, and it reflects by the polarization separation component by the side of the 2nd display device. At the time of the reflective display which makes the screen the field (front face of the 2nd display device) of another side The polarization separation component by the side of the 2nd [of said reflective means] display device is made to penetrate, and it is made to reflect the light which carried out incidence from the before [said 2nd display device] side, and penetrated this 2nd display device by the polarization separation component by the side of the 1st display device.

[0017]

According to this display, it reflects with a high reflection factor, without the polarization separation component of the pair of said reflective means absorbing most one polarization components between two polarization components different mutually [incident light], respectively, and since it is made to penetrate with high permeability, without absorbing most polarization components of another side, also when making which field of one side and another side into the screen, the reflective display of sufficient brightness can be performed.

[0018]

The display of this invention makes each rear face counter mutually, and arranges the 1st and the 2nd display device which control transparency and cutoff of the light which carried out incidence from the side before being the observation side of a display to the reverse sense. Thus, between said the 1st and 2nd display device One polarization component is reflected between two polarization components different mutually [incident light]. Have the polarization separation component of the pair which makes the polarization component of another side penetrate, and the light of the polarization component which penetrated the polarization separation component of one of these is reflected by the polarization separation component of another side. Also when making which field of one side and another side into the screen by arranging a reflective means to reflect the light of the polarization component which penetrated the polarization separation component of said another side by one [said] reflective polarizing element, it enables it to perform the reflective display of sufficient brightness.

[0019]

In the display of this invention, the polarization separation component of the pair of said reflective means has the desirable reflective polarizing element which makes the linearly polarized light component of another side in which the linearly polarized light component was reflected in and while it had a transparency shaft and a reflective shaft in the direction which intersects perpendicularly mutually, respectively and had a plane of vibration parallel to said reflective shaft between two linearly polarized light components which intersect perpendicularly mutually [incident light] had a plane of vibration parallel to said transparency shaft penetrate.

[0020]

In that case, what is necessary is just to consider said reflective means as the configuration which has arranged further the phase contrast plate to which each transparency shaft is made to cross mutually, and the reflective polarizing element of said pair is arranged, or the polarization condition of the transmitted light is changed between the reflective polarizing elements of said pair.

[0021]

After countering a near substrate and a before [this] side substrate in the display of this invention before being the observation side of a display, said the 1st and 2nd display device moreover, between side substrates The liquid crystal cell in which the liquid crystal layer which controls the polarization condition of the transmitted light according to the electric field impressed was prepared is pinched. Before and after that The inside of two linearly polarized light components which have a transparency shaft and an absorption shaft in the direction which intersects perpendicularly mutually, and intersect perpendicularly mutually [incident light], When considering as the liquid crystal display component by which the absorption polarizing plate of the pair which absorb a polarization component, and while it is parallel to said absorption shaft is parallel to said transparency shaft, and also makes the polarization component of a way penetrate has been arranged, The reflective polarizing element by the side of said 1st liquid crystal display component among the reflective polarizing elements of the pair of said reflective means The transparency shaft of the absorption polarizing plate on the backside [said 1st liquid crystal display component] is substantially set as the transparency shaft at parallel, and it is arranged, and, as for the reflective polarizing element by the side of said 2nd liquid crystal display component, it is desirable to set substantially the transparency shaft of the absorption polarizing plate on the backside [said 2nd display device] as the transparency shaft at parallel, and to arrange it.

[0022]

In the display of this invention furthermore, said reflective means The circular polarization of light detached core which one circular polarization of light component is reflected [detached core] between two circular polarization of light components of the right-handed rotation and left-handed rotation of incident light, and makes the circular polarization of light component of another side penetrate, It is arranged at one field side of said circular polarization of light detached core, make into the circular polarization of light the linearly polarized light which carried out incidence to the field which counters said circular polarization of light detached core from the opposite side, and incidence is carried out to said circular polarization of light detached core. It is good also as a configuration which it has the polarization separation component of a pair which consists of a phase contrast plate which makes the circular polarization of light which carried out outgoing radiation from said circular polarization of light detached core the linearly polarized light, and carries out outgoing radiation from said opposite side, and said each circular polarization of light detached core was opposed mutually, and has arranged these polarization separation components.

[0023]

In the display of this invention moreover, said reflective means The light guide plate which is made to penetrate the light which carried out incidence from the field of one side and another side, respectively, and carries out outgoing radiation of the incident light from an end face from one [at least] field of said one side and another side between the polarization separation components of said pair, It is desirable to consider as the configuration which has arranged further the surface light source which consists of a light emitting device which was made to counter said end face of this light guide plate, and was prepared.

[0024]

In addition, when making said reflective means equipped with said surface light source and considering as the configuration which has arranged the phase contrast plate between the reflective polarizing elements of said pair as said reflective means was mentioned above, it is good also considering the light guide plate of said surface light source as said phase contrast plate.

[0025]

[Embodiment of the Invention]

The mimetic diagram in which drawing 1 - drawing 4 show the 1st example of this invention, and the decomposition perspective view, drawing 2 , and drawing 3 of a display show the transparency path of the time of making one field of said display into the screen and the incident light when making the field of another side into the screen as for drawing 1 , and drawing 4 are the perspective views showing an example of electronic equipment which has a display to both sides.

[0026]

First, the body 1 of a device which this electronic equipment is a portable telephone and equipped the front face with two or more keys 2 when the electronic equipment shown in drawing 4 was explained, It consists of a lid 3 formed rotatable. an end is supported pivotably in the rising wood of said body 1 of a device -- having -- said body 1 of a device -- receiving -- closing motion -- When a lid 3 is closed like the inside of said lid 3, i.e., drawing 4 , (a), the body 1 of a device is countered, and Displays A and B are formed in the field which becomes positive when a lid 3 is opened like drawing 4 (b), and the external surface of said lid 3, respectively.

[0027]

When the display of the 1st example of this invention is explained, next, the display of this example The 1st and the 2nd display device 10A and 10B which control transparency and cutoff of the light which carried out incidence from the side before the observation side of a display made the rear face which is a field of the opposite side counter mutually, has been arranged at the reverse sense and was an observation side of a display, respectively, as shown in drawing 1 , It has said 1st [the] and the reflective means 20 arranged between the 2nd display device 10A and 10B.

[0028]

Said display devices 10A and 10B For example, the near transparence substrate 12 before it is a liquid crystal display component and all are the observation sides of a display, After countering the before [this] side substrate 12, the near transparence substrate 13 is joined through the frame-like sealant 14. The liquid crystal cell 11 by which the liquid crystal layer 15 (drawing 2 and R> drawing 3 3 reference) which controls the polarization condition of the transmitted light according to the electric field impressed was formed in these substrates 12 and the field surrounded by said sealant 14 between 13, It consists of polarizing plates 16 and 17 of the pair arranged before and behind that on both sides of said liquid crystal cell 11.

[0029]

In addition, although omitted by a diagram, the transparent electrode which forms two or more pixels arranged in the shape of a matrix by the field which counters mutually the inside which counters the liquid crystal layer 15 of the substrates 12 and 13 before and behind said liquid crystal cell 11 is prepared, and the orientation film is prepared on it.

[0030]

This liquid crystal cell 11 is an active-matrix liquid crystal cell which uses TFT (thin film transistor) as an active element. Two or more pixel electrodes arranged in the shape of a matrix in a line writing direction and the direction of a train to the inside of the substrate 13 of one of these, for example, a backside substrate, Two or more gate wiring which supplies a gate signal to two or more TFT(s) connected to these pixel electrodes, respectively, and TFT of each line, respectively, Two or more data wiring which supplies a data signal to TFT of each train, respectively is prepared. Before being the substrate of another side, the inside of the side substrate 12 is made to counter said two or more pixel electrodes, respectively, and the color filter of three colors of two or more colors which arranged by turns and were formed, for example, red, green, and blue, and the counterelectrode of the shape of one-sheet film which counters said two or more pixel electrodes are prepared.

[0031]

Moreover, said liquid crystal display components 10A and 10B are all the things of TN (Twisted Nematic) mold, and the liquid crystal layer 15 of the liquid crystal cell 11 consists of a pneumatic liquid crystal forward in the dielectric anisotropy the liquid crystal molecule carried out [the anisotropy] twist orientation on the 90-degree twist square substantially between the substrate 12 of order, and 13.

[0032]

The direction [a / arrow-head 12/ on drawing 1 and / near the before / said liquid crystal cell 11 / side substrate 12] of liquid crystal molecular orientation, Arrow-head 13a shows the direction [/ near the backside substrate 13] of liquid crystal molecular orientation. In drawing, direction of liquid crystal molecular orientation 12a [/ near the before / 1st upper liquid crystal display component 10A / side substrate (it sets to drawing and is an upper substrate) 12] As opposed to the axis of abscissa (axis of abscissa of a screen) x of the 1st [which was set up in parallel mutually] and 2nd liquid crystal display components 10A and 10B One direction, See from a before side and for example, direction of liquid crystal molecular orientation 13a [/ near a 45-degree direction and the backside substrate (it sets to drawing and is a lower substrate) 13] substantially in the clockwise direction It sees from a direction [of another side], i.e., before, side to said axis of abscissa x, and is in the counterclockwise direction in the 45-degree direction substantially. The liquid crystal molecule of the liquid crystal layer 15 of this 1st liquid crystal display component 10A As the broken-line arrow head showed, toward the backside substrate 13 to the before side substrate 12, the twist direction is seen to drawing 1 from a before side, and is carrying out twist orientation to it on the 90-degree twist square substantially in the clockwise direction.

[0033]

On the other hand in drawing 1 , direction of liquid crystal molecular orientation 12a [/ near the before / 2nd lower liquid crystal display component 10B / side substrate (it sets to drawing and is a lower substrate) 12] The direction which intersects perpendicularly substantially to direction of liquid crystal molecular orientation 12a [/ near the before / said 1st liquid crystal display component 10A / side substrate 12] (it sees from a before side to an axis of abscissa x, and is a 45-degree direction substantially in the right-handed rotation), Direction of liquid crystal molecular orientation 13a [/ near the side substrate (it sets to drawing and is an upper substrate) 13] the back It tends (it sees from a before side to an axis of abscissa x, and is a 45-degree direction substantially in the left-handed rotation) to intersect perpendicularly substantially to direction of liquid crystal molecular orientation 13a [/ near the backside / said 1st liquid crystal display component 10A / substrate 13]. Toward the backside substrate 13 to the before side substrate 12, that twist direction is seen to drawing 1 from a before side, and the liquid crystal molecule of the liquid crystal layer 15 of this 2nd liquid crystal display component 10B is carrying out twist orientation to it on the 90-degree twist square substantially in the counterclockwise direction (seeing from the backside in drawing 1 right-handed rotation), as the broken-line arrow head showed.

[0034]

In addition, the directions 12a and 13a of liquid crystal molecular orientation near the before [said 1st and 2nd liquid crystal display component 10A and 10B] side substrate 12, and the backside substrate 13 Direction of liquid crystal molecular orientation 12a near the before [each liquid crystal display component 10A and 10B] side substrate 12 is substantially made parallel, and even if substantially parallel to the above and reverse in direction of liquid crystal molecular orientation 13a near the backside [each liquid crystal display component 10A and 10B] substrate 13, it is good for them.

[0035]

The polarizing plates 16 and 17 of the pair arranged on both sides of the liquid crystal cell 11 of said 1st and 2nd liquid crystal display component 10A and 10B moreover, respectively It has the transparency shafts 16a and 17a and an absorption shaft (not shown) in the direction which intersects perpendicularly mutually. While had a plane of vibration parallel to said absorption shaft between two linearly polarized light components which intersect perpendicularly mutually [incident light], and a linearly polarized light component is absorbed. It is the absorption polarizing plate which makes the linearly polarized light component of another side with a plane of vibration parallel to said transparency shafts 16a and 17a penetrate. The absorption polarizing plate 16 by the side of before Set the transparency shaft 16a to direction of liquid crystal molecular orientation 12a [/ near the before / said liquid crystal cell 11 / side substrate 12] substantially at a rectangular cross or parallel (it intersects perpendicularly by a diagram), and it is stuck on the external surface of the before [said liquid crystal cell 11] side substrate 12. The absorption polarizing plate 17 on the backside makes transparency shaft 16a of the absorption polarizing plate 16 by the side of before [said], and the transparency shaft 17a cross at right angles substantially, and is stuck on the external surface of the backside [said liquid crystal cell 11] substrate 13.

[0036]

That is, the absorption polarizing plate 16 by the side of before said 1st and 2nd liquid crystal display component 10A and 10B makes each transparency shaft 16a intersect perpendicularly mutually substantially, and is arranged, and after being the opposed face side of said 1st and 2nd liquid crystal display component 10A and 10B, the near absorption polarizing plate 17 makes each transparency shaft 17a intersect perpendicularly mutually substantially, and is arranged.

[0037]

Moreover, the reflective means 20 arranged between said 1st liquid crystal display component 10A and 2nd liquid crystal display component 10B has the polarization separation components 21 and 22 of a pair, and has further composition which has arranged the surface light source 24 among these polarization separation components 21 and 22.

[0038]

The polarization separation components 21 and 22 of said pair For example, the inside of two linearly polarized light components which intersect perpendicularly mutually [incident light], It is the reflective polarizing element which one linearly polarized light component is reflected [polarizing element] and makes the linearly polarized light component of another side penetrate. In this example It has the transparency shafts 21a and 22a and the reflective shafts 21b and 22b in the direction which intersects perpendicularly mutually. The light of a linearly polarized light component with a plane of vibration parallel to said reflective shafts 21b and 22b is reflected, and the reflective polarizing plate which makes the light of a linearly polarized light component with a plane of vibration parallel to said transparency shafts 21a and 22a penetrate is used. Hereafter, these polarization separation components 21 and 22 are called reflective polarizing element.

[0039]

And the reflective polarizing elements 21 and 22 of said pair While making each transparency shaft 21a and 22a intersect perpendicularly mutually substantially Transparency shaft 21a of the reflective polarizing element 21 by the side of 1st liquid crystal display component 10A (henceforth the 1st reflective polarizing element) It carries out to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 1st liquid crystal display component 10A] substantially at parallel. Transparency shaft 22a of the reflective polarizing element 22 by the side of 2nd liquid crystal display component 10B (henceforth the 2nd reflective polarizing element) is substantially set to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 2nd liquid crystal display component 10B] at parallel, and it is arranged.

[0040]

Moreover, the surface light source 24 arranged between said 1st and 2nd reflective polarizing element 21 and 22 makes the light which carried out incidence from the field of one side and another side penetrate, respectively, and consists of a light guide plate 25 which carries out outgoing radiation of the incident light from an end face from one [at least] field of said one side and another side, and a light emitting device 26 which was made to counter said end face of this light guide plate 25, and was prepared.

[0041]

In addition, although the surface light source 24 used in this example is made to counter the end face of said light guide plate 25 and arranges said two or more light emitting devices 26 which consist of LED (light emitting diode), a straight pipe-like cold cathode tube etc. is sufficient as the light emitting device which is made to counter the end face of said light guide plate 25, and is arranged.

[0042]

While making the light which this surface light source 24 made penetrate the light which carried out incidence from one field of said light guide plate 25, carried out outgoing radiation from the field of another side of this light guide plate 25, and carried out incidence from the field of another side of said light guide plate 25 penetrate and carrying out outgoing radiation from one field of this light guide plate 25 The light which carried out outgoing radiation from said light emitting device 26 and which carried out incidence to said light guide plate 25 from the end face It is what draws the inside of a light guide plate 25, and carries out outgoing radiation from the field of one of these, and the field of another side while this light guide plate 25 reaches on the other hand and total reflection is carried out by the interface of the field of another side, and the open air (air). Said light emitting device 26 When using a display under the environment where the outdoor daylight of sufficient brightness is obtained, the light is put out, and the light is switched on when using a display under the environment where the outdoor daylight of sufficient brightness is not obtained.

[0043]

In addition, although omitted by a diagram In either field of one side of said light guide plate 25, and another side Two or more groove crevices which reflect the light which has progressed the inside of this light guide plate 25 toward that field in the direction in which the include angle to the normal of said surface of light-guard plate becomes small are formed in a light guide plate end face and parallel. Therefore, the light which has drawn the inside of said light guide plate 25 mainly carries out outgoing radiation to the field in which said groove crevice of said light guide plate 25 was formed from the field of the opposite side.

[0044]

An air space is prepared, respectively between the field [of both said light guide plates 25], said 1st, and 2nd reflective polarizing elements 21 and 22, and this surface light source 24 is arranged while making one field of said light guide plate 25 counter said 1st reflective polarizing element 21 and making the field of another side of said light guide plate 25 counter said 2nd reflective polarizing element 22.

[0045]

This display for example, in the lid 3 of the electronic equipment (portable telephone) shown in drawing 4 One field, for example, front face of 1st liquid crystal display component 10A, side (it sets to drawing 1 and is the bottom) of said liquid crystal display is made into the display A of the display A of the inside of said lid 3. The field, i.e., front face of 2nd liquid crystal display component 10B, side (it sets to drawing 1 and is the bottom) of another side is mounted as a display B of the external surface of said lid 3.

[0046]

The reflective display whose display of this makes one screen the front face of said 1st liquid crystal display component 10A, It is what performs the reflective display which makes the front face of said 2nd liquid crystal display component 10B the screen of another side. Said 1st liquid crystal display component 10A It drives so that transparency and cutoff of incident light may be controlled, when making one field into the screen, and when making the field of another side into the screen, said 2nd liquid crystal display component 10B is driven so that transparency and cutoff of incident light may be controlled.

[0047]

moreover, also when making one field into the screen, and also when making the field of another side into the screen, under the environment where the outdoor daylight of sufficient brightness is obtained, this display The reflective display using the outdoor daylight which carried out incidence from the side before being the observation side of a display is performed. When the outdoor daylight of sufficient brightness is not obtained, the transparency display which is made to carry out outgoing radiation of the illumination light from the surface light source 24 of said reflective means 20, and uses the illumination light is performed, and any display is observed from a transverse plane (direction near the normal of a screen).

[0048]

As shown in drawing 1 , the display of this example said 1st and 2nd liquid crystal display component 10A and 10B in addition, respectively In order to make transparency shaft 16a of the absorption polarizing plate 16 by the side of before [the], and transparency shaft 17a of the absorption polarizing plate 17 on the backside intersect perpendicularly substantially, The reflective display and transparency display when making one field into the screen, and the reflective display and transparency display when making the field of another side into the screen The display at the time of the non-electric field which do not impress electric field to the liquid crystal layer 15 of said liquid crystal cell 11 (when the orientation condition of the liquid crystal molecule of the liquid crystal layer 15 is early twist orientation) is the so-called display in the no MARI White mode which is clear display.

[0049]

The mimetic diagram and drawing 3 which show the transparency path of incident light in case drawing 2 makes the screen one field (front face of 1st liquid crystal display component 10A) of said display are the mimetic diagram showing the transparency path of the incident light when making the field (front face of 2nd liquid crystal display component 10B) of another side into the screen.

[0050]

First, if the transparency path of the incident light when making one field into the screen is explained, drawing 2 (a) shows the transparency path of the incident light at the time of the reflective display which makes one field the screen, and drawing 2 (b) shows the transparency path of the incident light at the time of the transparency display which makes one field the screen.

[0051]

At the time of the reflective display which makes one [said] field the screen The inside of two linearly polarized light components which intersect perpendicularly like drawing 2 (a) mutually [the outdoor daylight (unpolarized light) which carried out incidence to 1st liquid crystal display component 10A from the before side], A linearly polarized light component with a plane of vibration parallel to the absorption shaft of the absorption polarizing plate 16 by the side of before said 1st liquid crystal display component 10A The linearly polarized light component which was absorbed with this absorption polarizing plate 16, and had a plane of vibration parallel to transparency shaft 16a of said absorption polarizing plate 16 This absorption polarizing plate 16 is penetrated, it becomes the linearly polarized light S parallel to transparency shaft 16a of said absorption polarizing plate 16, and incidence is carried out to the liquid crystal cell 11 of 1st liquid crystal display component 10A from that before side.

[0052]

In response to a birefringence operation of the liquid-crystal layer 15 according to the orientation condition of the liquid-crystal molecule which changes with the electric fields impressed to inter-electrode [of said liquid crystal cell 11], outgoing radiation of the linearly polarized light S which carried out incidence to said liquid crystal cell 11 from that before side is carried out to the backside [this liquid crystal cell 11], and it is intercepted with the absorption polarizing plate 17 on the backside, or penetrates the absorption polarizing plate 17 on said backside, and it carries out outgoing radiation to the backside [said 1st liquid crystal display component 10A].

[0053]

Namely, the orientation condition of the liquid crystal molecule at the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) It is the twist orientation of a 90-degree twist angle substantially. At this time As shown in the left-hand side of drawing 2 (a), the linearly polarized light S which penetrated the absorption polarizing plate 16 by the side of before [said], and carried out incidence to the liquid crystal cell 11 In order to carry out 90-degree rotatory polarization substantially according to a birefringence operation of the liquid crystal layer 15, to become the linearly polarized light P parallel to transparency shaft 17a of the absorption polarizing plate 17 on the backside and to carry out outgoing radiation to the backside [a liquid crystal cell 11], at the time of this non-electric field Said linearly polarized light P which carried out outgoing radiation to the backside [said liquid crystal cell 11] penetrates the absorption polarizing plate 17 on said backside, and carries out outgoing radiation to the backside [1st liquid crystal display component 10A].

[0054]
Incidence of said linearly polarized light P which carried out outgoing radiation to the backside [said 1st liquid crystal display component 10A] is carried out to said reflective means 20.
[0055]
And transparency shaft 21a of the 1st reflective polarizing element 21 by the side of 1st [of said reflective means 20] liquid crystal display component 10A Since it is substantially parallel to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 1st liquid crystal display component 10A], as for said linearly polarized light P which carried out outgoing radiation to the backside [said 1st liquid crystal display component 10A] and which carried out incidence to said reflective means 20, the most penetrates said 1st reflective polarizing element 21.
[0056]
Said linearly polarized light P which penetrated said 1st reflective polarizing element 21 penetrates the light guide plate 25 of the surface light source 24, it carries out incidence to the 2nd reflective polarizing element 22 of said reflective means 20, and it is reflected by this 2nd reflective polarizing element 22.
[0057]
Namely, since the transparency shafts 21a and 22a of said 1st reflective polarizing element 21 and the 2nd reflective polarizing element 22 lie at right angles mutually substantially, Said linearly polarized light P which penetrates said 1st reflective polarizing element 21, and carries out incidence to the 2nd reflective polarizing element 22 It is the light of a linearly polarized light component with a plane of vibration parallel to reflective shaft 22b of said 2nd reflective polarizing element 22, therefore most of the light is reflected by said 2nd reflective polarizing element 22.
[0058]
Outgoing radiation of said linearly polarized light P reflected by said 2nd reflective polarizing element 22 is carried out from the field which penetrates again the light guide plate 25 of said surface light source 24, penetrates said 1st reflective polarizing element 21 further, and counters 1st liquid crystal display component 10A of said reflective means 20, and it carries out incidence to said 1st liquid crystal display component 10A from an after that side.
[0059]
The linearly polarized light P which carried out incidence to said 1st liquid crystal display component 10A from the after that side Penetrate the absorption polarizing plate 17 on the backside [this 1st liquid crystal display component 10A], 90-degree rotatory polarization is substantially carried out by the liquid crystal layer 15 of a liquid crystal cell 11, and it becomes the linearly polarized light S parallel to transparency shaft 16a of the absorption polarizing plate 16 by the side of before. The absorption polarizing plate 16 by the side of before [said] is penetrated, and outgoing radiation is carried out to a before [said 1st liquid crystal display component 10A] side.
[0060]
As shown in the right-hand side of drawing 2 (a) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 1st liquid crystal display component 10A] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light S which carried out [the linearly polarized light] incidence from the before [1st liquid crystal display component 10A] side, penetrated the absorption polarizing plate 16 by the side of before [the], and carried out incidence to the liquid crystal cell 11 Said liquid crystal cell 11 is penetrated with that polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, incidence is carried out to the absorption polarizing plate 17 on the backside, and it is absorbed with this absorption polarizing plate 17.
[0061]
Therefore, the display at the time of the non-electric field at the time of the reflective display which makes the screen one [said] field (front face of 1st liquid crystal display component 10A) is clear

display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0062]

At moreover, the time of the transparency display which makes one [said] field the screen The light emitting device 26 of the surface light source 24 of said reflective means 20 is turned on, and the outgoing radiation light from said light emitting device 26 like drawing 2 (b) The inside of a light guide plate 25 can be drawn carrying out incidence to a light guide plate 25 from that end face, and carrying out total reflection by the interface of the one side of this light guide plate 25, the field, and the air space of an outside of another side, and outgoing radiation is carried out from one field of said light guide plate 25, and the field of another side.

[0063]

And the illumination light which carried out outgoing radiation from the field which counters the 1st reflective polarizing element 21 of said light guide plate 25 Incidence is carried out to said 1st reflective polarizing element 21. The linearly polarized light S parallel to reflective shaft 21b of said 1st reflective polarizing element 21 among the light (unpolarized light) It is reflected by this 1st reflective polarizing element 21, and the linearly polarized light P parallel to transparency shaft 21a of said 1st reflective polarizing element 21 penetrates this 1st reflective polarizing element 21, and carries out outgoing radiation to said 1st liquid crystal display component 10A side.

[0064]

Moreover, the illumination light which carried out outgoing radiation from the field which counters the 2nd reflective polarizing element 22 of said light guide plate 25 Incidence is carried out to said 2nd reflective polarizing element 22 which transparency shaft 22a is made to intersect perpendicularly substantially to transparency shaft 21a of said 1st reflective polarizing element 21, and is arranged. The linearly polarized light S parallel to transparency shaft 22a of said 2nd reflective polarizing element 22 among the light (unpolarized light) This 2nd reflective polarizing element 22 is penetrated, outgoing radiation is carried out to the 2nd liquid crystal display component 10B side, and the linearly polarized light P parallel to reflective shaft 22b of said 2nd reflective polarizing element 22 is reflected by this 2nd reflective polarizing element 22.

[0065]

The linearly polarized light P reflected by said 2nd reflective polarizing element 22 penetrates said light guide plate 25, penetrates the 1st reflective polarizing element 21 further, and it carries out outgoing radiation to the 1st liquid crystal display component 10A side.

[0066]

Said linearly polarized light S reflected by said 1st reflective polarizing element 21 among the illumination light which carried out outgoing radiation on the other hand from the field which counters the 1st reflective polarizing element 21 of said light guide plate 25 penetrates said light guide plate 25, penetrates said 2nd reflective polarizing element 22 further, and it carries out outgoing radiation to the 2nd liquid crystal display component 10B side.

[0067]

Thus, the linearly polarized light P which carried out outgoing radiation of said reflective means 20 from the field which counters the 1st reflective polarizing element 21 of said light guide plate 25 among the illumination light from the surface light source 24, and penetrated said 1st reflective polarizing element 21 Outgoing radiation is carried out from the field which counters the 2nd reflective polarizing element 22 of said light guide plate 25. While carrying out outgoing radiation of the linearly polarized light P which was reflected by said 2nd reflective polarizing element 22, and penetrated said 1st reflective polarizing element 21 to said 1st liquid crystal display component 10A side The linearly polarized light S which carried out outgoing radiation from the field which counters the 2nd reflective polarizing element 22 of said light guide plate 25, and penetrated said 2nd reflective polarizing element 22 Outgoing radiation is carried out from the field which counters the 1st reflective polarizing element 21 of said light guide plate

25, and outgoing radiation of the linearly polarized light S which was reflected by said 1st reflective polarizing element 21, and penetrated said 2nd reflective polarizing element 22 is carried out to said 2nd liquid crystal display component 10B side.

[0068]

That is, this reflective means 20 carries out outgoing radiation of about 50% of the illumination light from said surface light source 24 to the 1st liquid crystal display component 10A side as the linearly polarized light P, and carries out outgoing radiation of other about 50% to the 2nd liquid crystal display component 10B side as the linearly polarized light S.

[0069]

therefore, the linearly polarized light P which carries out outgoing radiation to the 1st liquid crystal display component 10A side from this reflective means 20 and the linearly polarized light S which carries out outgoing radiation to said 2nd liquid crystal display component 10B side -- abbreviation -- it is the light of the same reinforcement.

[0070]

In addition, although said light guide plate 25 mainly carries out outgoing radiation of the light which has drawn the inside of this light guide plate 25 to the field in which the groove crevice which is not illustrated was formed from the field of the opposite side as mentioned above About 50% of the light which carried out outgoing radiation from the field which counters the 1st reflective polarizing element 21 of said light guide plate 25 In order that about 50% of the light which carried out outgoing radiation from the field which counters the 2nd reflective polarizing element 22 turns into the linearly polarized light P, outgoing radiation is carried out to the 1st liquid crystal display component 10A side, and every about 50% of other light may turn into the linearly polarized light S and may carry out outgoing radiation to the 2nd liquid crystal display component 10B side, Even if said light guide plate 25 makes the forming face of said groove crevice counter any of said 1st and 2nd reflective polarizing element 21 and 22 and is arranged, outgoing radiation of the linearly polarized light P and the linearly polarized light S of the same reinforcement can be substantially carried out to the 1st liquid crystal display component 10A and 2nd liquid crystal display component 10B side.

[0071]

And the linearly polarized light P which carried out outgoing radiation to the 1st liquid crystal display component 10A side from said reflective means 20 penetrates the absorption polarizing plate 17 on the backside [this 1st liquid crystal display component 10A], it carries out incidence to a liquid crystal cell 11 from an after that side, and it carries out outgoing radiation to a before [said liquid crystal cell 11] side in response to a birefringence operation of the liquid crystal layer 15 according to the orientation condition of the liquid crystal molecule which changes with the electric fields impressed to inter-electrode [of said liquid crystal cell 11].

[0072]

At namely, the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 2 (b), the linearly polarized light P which carried out incidence to said liquid crystal cell 11 from the after that side 90-degree rotatory polarization is substantially carried out according to a birefringence operation of the liquid crystal layer 15, it becomes the linearly polarized light S parallel to transparency shaft 16a of the absorption polarizing plate 16 by the side of before, and outgoing radiation is carried out to a before [a liquid crystal cell 11] side, the absorption polarizing plate 16 by the side of before [said] is penetrated, and outgoing radiation is carried out to a before [said 1st liquid crystal display component 10A] side.

[0073]

As shown in the right-hand side of drawing 2 (b) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 1st liquid crystal display component 10A] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light P which carried out incidence to said liquid crystal cell 11 from the after that side penetrates said liquid crystal cell 11 with that polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, carries out incidence to the absorption polarizing plate 16 by the side of before, and is absorbed with this absorption polarizing plate 16.

[0074]

Therefore, the display at the time of the non-electric field at the time of the transparency display which makes the screen one [said] field (front face of 1st liquid crystal display component 10A) is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0075]

At in addition, the time of the display which makes the screen one [said] field, i.e., the front face of 1st liquid crystal display component 10A Since the liquid crystal cell 11 of 2nd liquid crystal display component 10B is in the condition of non-electric field (V= 0) of not driving, The linearly polarized light S which carried out outgoing radiation of one [said] field to the 2nd liquid crystal display component 10B side from said reflective means 20 at the time of the transparency display given the screen Penetrate the absorption polarizing plate 17 on the backside [this 2nd liquid crystal display component 10B], and incidence is carried out to a liquid crystal cell 11 from an after that side. Although 90-degree rotatory polarization is substantially carried out by birefringence operation of the liquid crystal layer 15, the absorption polarizing plate 16 by the side of before is penetrated and outgoing radiation is carried out to a before [said 2nd liquid crystal display component 10B] side (field side of another side of a display) Since the display which makes one [said] field the screen, i.e., the display of the display A of the lid inside of the electronic equipment shown in drawing 4 , is observed from [the] an inside where a lid 3 is opened like drawing 4 (b), the light which carries out outgoing radiation from a before [said 2nd liquid crystal display component 10B] side is not visible.

[0076]

Next, if the transparency path of the incident light when making the field of another side into the screen is explained, drawing 3 (a) shows the transparency path of the incident light at the time of the reflective display which makes the field of another side the screen, and drawing 3 (b) shows the transparency path of the incident light at the time of the transparency display which makes the field of another side the screen.

[0077]

The inside of two linearly polarized light components with which it intersects perpendicularly like drawing 3 (a) mutually [the outdoor daylight (unpolarized light) which carried out incidence to 2nd liquid crystal display component 10B from the before side] at the time of the reflective display which makes the field of another side the screen, A linearly polarized light component with a plane of vibration parallel to the absorption shaft of the absorption polarizing plate 16 by the side of before said 2nd liquid crystal display component 10B The linearly polarized light component which was absorbed with this absorption polarizing plate 16, and had a plane of vibration parallel to transparency shaft 16a of said absorption polarizing plate 16 This absorption polarizing plate 16 is penetrated, it becomes the linearly polarized light P parallel to transparency shaft 16a of said absorption polarizing plate 16, and incidence is carried out to the liquid crystal cell 11 of 2nd liquid crystal display component 10B from that before side.

[0078]

In response to a birefringence operation of the liquid-crystal layer 15 according to the orientation condition of the liquid-crystal molecule which changes with the electric fields impressed to inter-electrode [of said liquid crystal cell 11], outgoing radiation of the linearly polarized light P which carried out incidence to said liquid crystal cell 11 from that before side is carried out to the backside [this liquid crystal cell 11], and it is intercepted with the absorption polarizing plate 17 on the backside, or penetrates the absorption polarizing plate 17 on said backside, and it carries out outgoing radiation to the backside [said 2nd liquid crystal display component 10B].

[0079]
Namely, the orientation condition of the liquid crystal molecule at the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) It is the twist orientation of a 90-degree twist angle substantially. At this time As shown in the left-hand side of drawing 3 (a), the linearly polarized light P which penetrated the absorption polarizing plate 16 by the side of before, and carried out incidence to the liquid crystal cell 11 In order to carry out 90-degree rotatory polarization substantially according to a birefringence operation of the liquid crystal layer 15, to become the linearly polarized light S parallel to transparency shaft 17a of the absorption polarizing plate 17 on the backside and to carry out outgoing radiation to the backside [a liquid crystal cell 11], at the time of this non-electric field Said linearly polarized light S which carried out outgoing radiation to the backside [said liquid crystal cell 11] penetrates the absorption polarizing plate 17 on said backside, and carries out outgoing radiation to the backside [said 2nd liquid crystal display component 10B].

[0080]
Incidence of said linearly polarized light S which carried out outgoing radiation to the backside [said 2nd liquid crystal display component 10B] is carried out to said reflective means 20.

[0081]
And transparency shaft 22a of the 2nd reflective polarizing element 22 by the side of 2nd [of said reflective means 20] liquid crystal display component 10B Since it is substantially parallel to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 2nd liquid crystal display component 10B], as for said linearly polarized light S which carried out outgoing radiation to the backside [said 2nd liquid crystal display component 10B] and which carried out incidence to said reflective means 20, the most penetrates said 2nd reflective polarizing element 22.

[0082]
Said linearly polarized light S which penetrated said 2nd reflective polarizing element 22 penetrates the light guide plate 25 of the surface light source 24, it carries out incidence to the 1st reflective polarizing element 21 of said reflective means 20, and it is reflected by this 1st reflective polarizing element 21.

[0083]
Namely, since the transparency shafts 22a and 21a of said 2nd reflective polarizing element 22 and the 1st reflective polarizing element 21 lie at right angles mutually substantially, Said linearly polarized light S which penetrates said 2nd reflective polarizing element 22, and carries out incidence to the 1st reflective polarizing element 21 It is the light of a linearly polarized light component with a plane of vibration parallel to reflective shaft 21b of said 1st reflective polarizing element 21, therefore most of the light is reflected by said 1st reflective polarizing element 21.

[0084]
And outgoing radiation of said linearly polarized light S reflected by said 1st reflective polarizing element 21 is carried out from the field which penetrates again the light guide plate 25 of said surface light source 24, penetrates said 2nd reflective polarizing element 22 further, and counters 2nd liquid crystal display component 10B of said reflective means 20, and it carries out incidence to said 2nd liquid crystal display component 10B from an after that side.

[0085]
The linearly polarized light S which carried out incidence to said 2nd liquid crystal display component 10B Penetrate the absorption polarizing plate 17 on the backside [this 2nd liquid crystal display component 10B], 90-degree rotatory polarization is substantially carried out by the liquid crystal layer 15 of a liquid crystal cell 11, and it becomes the linearly polarized light P parallel to transparency shaft 16a of the absorption polarizing plate 16 by the side of before. The absorption polarizing plate 16 by the side of before [said] is penetrated, and outgoing radiation is carried out to a before [said 2nd liquid crystal display component 10B] side.

[0086]
As shown in the right-hand side of drawing 3 (a) at the time (V>Vth) of the electric-field impression

which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 2nd liquid crystal display component 10B] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light P which carried out [the linearly polarized light] incidence from the before [2nd liquid crystal display component 10B] side, penetrated the absorption polarizing plate 16 by the side of before [the], and carried out incidence to the liquid crystal cell 11 Said liquid crystal cell 11 is penetrated with that polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, incidence is carried out to the absorption polarizing plate 17 on the backside, and it is absorbed with the absorption polarizing plate 17 by the side of next.

[0087]

Therefore, the display at the time of the non-electric field at the time of the reflective display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of said another side is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0088]

Moreover, like the time of the transparency display which while mentioned above and makes a field the screen, the light emitting device 26 of the surface light source 24 of said reflective means 20 is turned on, the linearly polarized light P carries out outgoing radiation of the time of the transparency display which makes the field of said another side the screen to the 1st liquid crystal display component 10A side from said reflective means 20, and the linearly polarized light S carries out outgoing radiation to the 2nd liquid crystal display component 10B side.

[0089]

And the linearly polarized light S which carried out outgoing radiation to the 2nd liquid crystal display component 10B side from said reflective means 20 penetrates the absorption polarizing plate 17 on the backside [this 2nd liquid crystal display component 10B], it carries out incidence to a liquid crystal cell 11 from an after that side, and it carries out outgoing radiation to a before [this liquid crystal cell 11] side in response to a birefringence operation of the liquid crystal layer 15 according to the orientation condition of the liquid crystal molecule which changes with the electric fields impressed to inter-electrode [of said liquid crystal cell 11].

[0090]

At namely, the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 3 (b), the linearly polarized light S which carried out incidence to said liquid crystal cell 11 from the after that side 90-degree rotatory polarization is substantially carried out according to a birefringence operation of the liquid crystal layer 15, and it becomes the linearly polarized light P parallel to transparency shaft 16a of the absorption polarizing plate 16 by the side of before, and the linearly polarized light P penetrates the absorption polarizing plate 16 by the side of before [said], and carries out outgoing radiation to a before [said 2nd liquid crystal display component 10B] side.

[0091]

As shown in the right-hand side of drawing 3 (b) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 2nd liquid crystal display component 10B] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light S which carried out incidence to said liquid crystal cell 11 from the after that side penetrates said liquid crystal cell 11 with that polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, carries out incidence to the absorption polarizing plate 16 by the side of before, and is absorbed with this absorption polarizing plate 16.

[0092]

Therefore, the display at the time of the non-electric field at the time of the transparency display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of said another side is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0093]

At in addition, the time of the display which makes the screen the field of said another side, i.e., the front face of 2nd liquid crystal display component 10B Since the liquid crystal cell 11 of 1st liquid crystal display component 10A is in the condition of non-electric field (V= 0) of not driving, The linearly polarized light P which carried out outgoing radiation of the field of said another side to the 1st liquid crystal display component 10A side from said reflective means 20 at the time of the transparency display given the screen Penetrate the absorption polarizing plate 17 on the backside [this 1st liquid crystal display component 10A], and incidence is carried out to a liquid crystal cell 11 from an after that side. Although 90-degree rotatory polarization is substantially carried out by birefringence operation of the liquid crystal layer 15, the absorption polarizing plate 16 by the side of before is penetrated and outgoing radiation is carried out to a before [said 1st liquid crystal display component 10A] side (one field side of a display) Since the display which makes the field of said another side the screen, i.e., the display of the display B of the lid external surface of the electronic equipment shown in drawing 4 , is observed where a lid 3 is closed like drawing 4 (a), the light which carries out outgoing radiation from a before [said 2nd liquid crystal display component 10B] side is not visible.

[0094]

At thus, the time of the reflective display whose display of this makes the screen the field (front face of 1st liquid crystal display component 10A) of one of these The light which carried out incidence from the before [said 1st liquid crystal display component 10A] side, and penetrated this 1st liquid crystal display component 10A Make the reflective polarizing element 21 by the side of 1st [of said reflective means 20] liquid crystal display component 10A penetrate, and it reflects by the reflective polarizing element 22 by the side of 2nd liquid crystal display component 10B. At the time of the reflective display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of another side The light which carried out incidence from the before [said 2nd liquid crystal display component 10B] side, and penetrated this 2nd liquid crystal display component 10B The reflective polarizing element 22 by the side of 2nd [of said reflective means 20] liquid crystal display component 10B is made to penetrate, and it is made to reflect by the reflective polarizing element 21 by the side of 1st liquid crystal display component 10A.

[0095]

According to this display, it reflects with a high reflection factor, without the reflective polarizing elements 21 and 22 of the pair of said reflective means 20 absorbing most one linearly polarized light components between two linearly polarized light components different mutually [incident light], respectively, and since it is made to penetrate with high permeability, without absorbing most linearly polarized light components of another side, also when making which field of one side and another side into the screen, the reflective display of sufficient brightness can be performed.

[0096]

In this example, and the reflective polarizing elements 21 and 22 of the pair of said reflective means 20 Since each transparency shaft 21a and 22a was made to intersect perpendicularly mutually substantially, that is, transparency shaft 21a of one reflective polarizing element 21 and reflective shaft 22b of the reflective polarizing element 22 of another side were mutually made parallel substantially and are arranged, While reflecting most linearly polarized lights P which penetrated said 1st liquid crystal display component 10A, and carried out incidence to said reflective means 20 from the field of one of these at the time of the reflective display which makes one [said] field the screen with this reflective means 20 Most linearly polarized lights S which penetrated said 2nd liquid crystal display component 10B, and carried out incidence to said reflective means 20 from the field of that another side at the time of the reflective display which makes the field of said another side the screen can be reflected with this reflective means 20. Therefore, the indication can be given brighter also when making which field of one side and another side into the screen.

[0097]

In addition, although the reflective polarizing element of one of these is made to penetrate and outgoing radiation of most light which said reflective means 20 penetrated and carried out incidence of one reflective polarizing element among the reflective polarizing elements 21 and 22 of a pair, and it was reflected by the reflective polarizing element of another side, and carried out re-incidence to one [said] reflective polarizing element is carried out Among the light which carried out re-incidence to one [said] reflective polarizing element, it is reflected by the reflective polarizing element of one of these, and the multiple echo of a part of light is carried out among the reflective polarizing elements 21 and 22 of a pair, and they penetrates and carries out outgoing radiation of one [said] reflective polarizing element.

[0098]

Namely, while the incidence side carries out outgoing radiation of the great portion of light which carried out incidence from which field of the one side and another side to said incidence side by one reflection by the reflective polarizing elements 22 or 21 of the opposite side, said reflective means 20 Outgoing radiation is carried out to said incidence side from the perimeter of the light which is made to carry out the multiple echo of a part of light among the reflective polarizing elements 21 and 22 of a pair, and carries out outgoing radiation of the multiple echo light by said one reflection.

[0099]

Therefore, also when making which field of that one side and another side into the screen according to this display The reflected light which carried out outgoing radiation to the incidence side of said reflective means 20 at the incidence side of said reflective means 20 by one reflection by the reflective polarizing elements 21 or 22 of the opposite side, A multiple echo is carried out among the reflective polarizing elements 21 and 22 of the pair of said reflective means 20. Outgoing radiation of the reflected light which carried out outgoing radiation to the incidence side of said reflective means 20 from the perimeter of the light which carries out outgoing radiation by said one reflection can be carried out from said screen. Therefore, while enlarging outgoing radiation area of the light from the clear display section and, making said clear display section bright on the whole, the shadow of the dark display by said liquid crystal display components 10A and 10B can be abolished, and the reflective display of good quality without a twin image can be performed.

[0100]

The display of this example said reflective means 20 moreover, among the reflective polarizing elements 21 and 22 of said pair The light guide plate 25 which is made to penetrate the light which carried out incidence from the field of one side and another side, respectively, and carries out outgoing radiation of the incident light from an end face from one [at least] field of said one side and another side, Since it is considering as the configuration which has arranged further the surface light source 24 which consists of a light emitting device 26 which was made to counter said end face of this light guide plate 25, and was prepared, The reflective display using outdoor daylight and the transparency display using the illumination light from said surface light source 24 can be performed in both one [said] field and the field of another side, respectively.

[0101]

and said reflective means 20 was mentioned above -- as -- a 1st liquid crystal display component 10A side and the 2nd liquid crystal display component 10B side -- abbreviation -- since outgoing radiation of the linearly polarized light P and the linearly polarized light S of the same reinforcement is carried out, respectively, the display of the brightness same also at the time of the transparency display which makes one [said] field the screen, and the transparency display which makes the field of said another side the screen can be obtained.

[0102]

In this example, and the inside of the reflective polarizing elements 21 and 22 of the pair of said reflective means 20, Set the transparency shaft 21a to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 1st liquid crystal display component 10A] substantially at parallel, and the reflective polarizing element 21 by the side of said 1st liquid crystal display component 10A is arranged. Since the transparency shaft 22a was substantially set to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 2nd liquid crystal display component 10B] at parallel and the reflective polarizing element 22 by the side of said 2nd liquid crystal display component 10B is arranged, While carrying out incidence of most light which carried out outgoing radiation to the backside [said liquid crystal display components 10A and 10B] to said reflective polarizing elements 21 and 22 Incidence of most light which carried out outgoing radiation from said reflective polarizing elements 21 and 22 can be carried out to said liquid crystal display components 10A and 10B, therefore both one side and another side can be indicated bright enough also at the time of said reflective display and a transparency display.

[0103]

In addition, although each transparency shaft 21a and 22a was made to intersect perpendicularly mutually substantially and the reflective polarizing elements 21 and 22 of the pair of said reflective means 20 are arranged in the above-mentioned example Make each transparency shaft 21a and 22a cross aslant, and the reflective polarizing elements 21 and 22 of said pair are arranged. Light which a multiple echo is carried out among these reflective polarizing elements 21 and 22, and carries out outgoing radiation from the reflective means 20 may be made [many]. Even in such a case, by fully securing the light which makes the crossed axes angle of the transparency shafts 21a and 22a of the reflective polarizing elements 21 and 22 of said pair the include angle near a rectangular cross, and carries out outgoing radiation to the incidence side of said reflective means 20 by one reflection by the reflective polarizing element of the opposite side The display of brightness sufficient also at the time of the reflective display which makes one field the screen and a transparency display, and the reflective display which makes the field of another side the screen, and a transparency display can be obtained.

[0104]

Drawing 5 - drawing 7 show the 2nd example of this invention, and drawing 5 is the mimetic diagram showing the transparency path of the time of the decomposition perspective view, drawing 6 , and drawing 7 of a display making one field of said display the screen, and the incident light when making the field of another side into the screen.

[0105]

The display of this example arranges reflective means 20a equipped with the phase contrast plate 23 and the surface light source 24 among the reflective polarizing elements 21 and 22 of a pair between the 1st [which each rear face was made to counter mutually and has been arranged at the reverse sense], and 2nd liquid crystal display component 10A and 10B, as shown in drawing 5 .

[0106]

In addition, in this example, since said 1st liquid crystal display component 10A and 2nd liquid crystal display component 10B are the TN liquid crystal display devices of the same configuration as the thing of the 1st example fundamentally mentioned above and the surface light source 24 of said reflective means 20a is also the same configuration as the thing of the 1st example, that explanation attaches and omits a same sign to drawing.

[0107]

In this example, the phase contrast plate 23 arranged between the 1st [of said reflective means 20a], and 2nd reflective polarizing element 21 and 22 For example, it is lambda / 2 phase-contrast plate which gives 1/2 wave of phase contrast between Tsunemitsu, the transmitted light, and abnormality light, and aforementioned lambda / 2 phase-contrast plate 23 are arranged in this example between said 2nd reflective polarizing element 22 and light guide plates 25 of the surface light source 24.

[0108]

Moreover, direction of liquid crystal molecular orientation 12a [as this example showed to drawing 5 / near the before / each of the said 1st and 2nd liquid crystal display component 10A and 10B / side substrate 12], While making substantially direction of liquid crystal molecular orientation 13a [/ near the backside / each / substrate 13] parallel or cross at right angles (parallel by a diagram), respectively The absorption polarizing plate 16 by the side of before said 1st and 2nd liquid crystal display component 10A and 10B Each transparency shaft 16a was substantially made parallel, and has been arranged, after being the opposed face side of said 1st and 2nd liquid crystal display component 10A and 10B, each transparency shaft 17a was substantially made parallel, and the near absorption polarizing plate 17 is arranged.

[0109]

Furthermore, in this example, while making parallel substantially each transparency shaft 21a and 21a, the 1st [of said reflective means 20a], and 2nd reflective polarizing element 21 and 22 Transparency shaft 21a of the 1st reflective polarizing element by the side of 1st liquid crystal display component 10A is substantially set to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 1st liquid crystal display component 10A] at parallel. Set substantially transparency shaft 22a of the 2nd reflective polarizing element by the side of 2nd liquid crystal display component 10B to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 2nd liquid crystal display component 10B] at parallel, and it is arranged. The lagging-axis 23a was substantially shifted aslant at the include angle of 45 degrees to the transparency shafts 21a and 22a of both said 1st and 2nd reflective polarizing element 21 and 22, and aforementioned lambda / 2 phase-contrast plate 23 are arranged.

[0110]

If the transparency path of the incident light when making one field (front face of 1st liquid crystal display component 10A) of a reflective display of this display into the screen is explained, drawing 6 (a) shows the transparency path of the incident light at the time of the reflective display which makes one field the screen, and drawing 6 (b) shows the transparency path of the incident light at the time of the transparency display which makes one field the screen.

[0111]

Like drawing 6 (a), it carries out incidence of the time of the reflective display which makes one [said] field the screen to a liquid crystal cell 11, the outdoor daylight (unpolarized light) which carried out incidence to 1st liquid crystal display component 10A from that before side being used as the linearly polarized light S parallel to that transparency shaft 16a with the absorption polarizing plate 16 by the side of before this 1st liquid crystal display component 10A.

[0112]

At and the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 6 (a), said linearly polarized light S which carried out incidence to said liquid crystal cell 11 It becomes the linearly polarized light P parallel to transparency shaft 17a of the absorption polarizing plate 17 on the backside, and the absorption polarizing plate 17 on said backside is penetrated, outgoing radiation is carried out [90 degree rotatory polarization is substantially carried out by the liquid crystal layer 15,] to the backside [said 1st liquid crystal display component 10A], and incidence is carried out to said reflective means 20a.

[0113]

The linearly polarized light P which carried out incidence to said reflective means 20a The 1st reflective polarizing element 21 of said reflective means 20a and the light guide plate 25 of the surface light source 24 are penetrated, and 1/2 wave of phase contrast can be given with aforementioned lambda / 2 phase-contrast plate 23. The plane of vibration of said linearly polarized light P serves as the linearly polarized light S rotated 90 degrees substantially, carries out incidence to the 2nd reflective polarizing element 22, and is reflected by this 2nd reflective polarizing element 22.

[0114]
The linearly polarized light S reflected by said 2nd reflective polarizing element 22 is again made into the linearly polarized light P with aforementioned lambda / 2 phase-contrast plate 23, and it penetrates the light guide plate 25 of the surface light source 24, and the 1st reflective polarizing element 21, and outgoing radiation of it is carried out from said reflective means 20a, it penetrates again said 1st liquid crystal display component 10A, and it carries out outgoing radiation to the before side.
[0115]
At the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 1st liquid crystal display component 10A] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 3 or 4th page of a substrate As shown in the right-hand side of drawing 6 (a), incidence is carried out from a before [1st liquid crystal display component 10A] side. The linearly polarized light S which penetrated the absorption polarizing plate 16 by the side of before [the], and carried out incidence to the liquid crystal cell 11 penetrates said liquid crystal cell 11 with the polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, incidence is carried out to the absorption polarizing plate 17 on the backside, and most of the light is absorbed with the absorption polarizing plate 17 on said backside.
[0116]
Therefore, the display at the time of the non-electric field at the time of the reflective display which makes the screen one [said] field (front face of 1st liquid crystal display component 10A) is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).
[0117]
Moreover, the light emitting device 26 of the surface light source 24 of said reflective means 20a is turned on, and the outgoing radiation light from said light emitting device 26 carries out outgoing radiation of the time of the transparency display which makes one [said] field the screen from the field of one side of a light guide plate 25, and another side like drawing 6 (b).
[0118]
And the illumination light which carried out outgoing radiation from the field which counters the 1st reflective polarizing element 21 of said light guide plate 25 Incidence is carried out to said 1st reflective polarizing element 21. The linearly polarized light S parallel to reflective shaft 21b of said 1st reflective polarizing element 21 among the light (unpolarized light) It is reflected by this 1st reflective polarizing element 21, and the linearly polarized light P parallel to transparency shaft 21a of said 1st reflective polarizing element 21 penetrates this 1st reflective polarizing element 21, and carries out outgoing radiation to the 1st liquid crystal display component 10A side.
[0119]
The linearly polarized light S reflected by said 1st reflective polarizing element 21 among the light which carried out outgoing radiation on the other hand from the field which counters the 1st reflective polarizing element 21 of said light guide plate 25 It considers as the linearly polarized light P which penetrated said light guide plate 25 and 90 degrees of planes of vibration of said linearly polarized light S rotated substantially with aforementioned lambda / 2 phase-contrast plate 23, and the 2nd reflective polarizing element 22 is penetrated and outgoing radiation is carried out to the 2nd liquid crystal display component 10B side.
[0120]
Moreover, the illumination light which carried out outgoing radiation from the field which counters the 2nd reflective polarizing element 22 of said light guide plate 25 Penetrate aforementioned lambda / 2 phase-contrast plate 23 with an unpolarized light condition, and incidence is carried out to said 2nd reflective polarizing element 22. The linearly polarized light S parallel to reflective shaft 22b of said 2nd reflective polarizing element 22 among the light (unpolarized light) It is reflected by this 2nd reflective

polarizing element 22, and the linearly polarized light P parallel to transparency shaft 22a of said 2nd reflective polarizing element 22 penetrates this 2nd reflective polarizing element 22, and carries out outgoing radiation to the 2nd liquid crystal display component 10B side.

[0121]

The linearly polarized light S reflected by said 2nd reflective polarizing element 22 among the light which carried out outgoing radiation on the other hand from the field which counters the 2nd reflective polarizing element 22 of said light guide plate 25 It considers as the linearly polarized light P which 90 degrees of planes of vibration of said linearly polarized light S rotated substantially with aforementioned lambda / 2 phase-contrast plate 23, and said light guide plate 25 is penetrated, the 1st reflective polarizing element 21 is penetrated further, and outgoing radiation is carried out to the 1st liquid crystal display component 10A side.

[0122]

Namely, since the transparency shafts 21a and 21a of the 1st and 2nd reflective polarizing element 21 and 22 are substantially made parallel for said reflective means 22a and it is considering as the configuration which has arranged the surface light source 24, and the aforementioned aforementioned lambda / 2 phase-contrast plate 23 in the meantime in this example, Each of light which carries out outgoing radiation to the 1st liquid crystal display component 10A side from this reflective means 20a, and light which carries out outgoing radiation to said 2nd liquid crystal display component 10B side is the linearly polarized lights P.

[0123]

Moreover, the linearly polarized light P which carried out outgoing radiation of this reflective means 20a from the field which counters the 1st reflective polarizing element 21 of said light guide plate 25 among the illumination light from the surface light source 24, and penetrated said 1st reflective polarizing element 21 Carry out outgoing radiation from the field which counters the 2nd reflective polarizing element 22 of said light guide plate 25, and it is reflected by said 2nd reflective polarizing element 22. While carrying out outgoing radiation of the linearly polarized light P which was able to change the polarization condition with lambda / 2 phase-contrast plate 23 to said 1st liquid crystal display component 10A side The linearly polarized light P which carried out outgoing radiation from the field which counters the 2nd reflective polarizing element 22 of said light guide plate 25, and penetrated said 2nd reflective polarizing element 22 Carry out outgoing radiation from the field which counters the 1st reflective polarizing element 21 of said light guide plate 25, and it is reflected by said 1st reflective polarizing element 21. In order to carry out outgoing radiation of the linearly polarized light P which was able to change the polarization condition with aforementioned lambda / 2 phase-contrast plate 23 to said 2nd liquid crystal display component 10B side, the linearly polarized light P which carries out outgoing radiation to the 1st liquid crystal display component 10A side from this reflective means 20a, and the linearly polarized light P which carries out outgoing radiation to said 2nd liquid crystal display component 10B side -- abbreviation -- it is the light of the same reinforcement.

[0124]

And the linearly polarized light P which carried out outgoing radiation to the 1st liquid crystal display component 10A side from said reflective means 20 penetrates the absorption polarizing plate 17 on the backside [this 1st liquid crystal display component 10A], it carries out incidence to a liquid crystal cell 11 from an after that side, and it carries out outgoing radiation to a before [this liquid crystal cell 11] side in response to a birefringence operation of the liquid crystal layer 15 according to the orientation condition of the liquid crystal molecule which changes with the electric fields impressed to inter-electrode [of said liquid crystal cell 11].

[0125]

At namely, the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 6 (b), the linearly polarized light P which carried out incidence to said liquid crystal cell 11 from the after that side 90-degree rotatory polarization is substantially carried out according to a birefringence operation of the liquid crystal layer 15, and it becomes the linearly polarized light S, and the linearly polarized light S penetrates the absorption polarizing plate 16 by the side of before, and carries out outgoing radiation to a before [said 1st liquid crystal display component 10A] side.

[0126]

As shown in the right-hand side of drawing 6 (b) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 1st liquid crystal display component 10A] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light P which carried out incidence to said liquid crystal cell 11 from the after that side carries out incidence to the absorption polarizing plate 16 by the side of before with the polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, and most of the light is absorbed with the absorption polarizing plate 16 by the side of before [said].

[0127]

Therefore, the display at the time of the non-electric field at the time of the transparency display which makes the screen one [said] field (front face of 1st liquid crystal display component 10A) is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0128]

Next, if the transparency path of the incident light when making the field of another side into the screen is explained, drawing 7 (a) shows the transparency path of the incident light at the time of the reflective display which makes the field of another side the screen, and drawing 7 (b) shows the transparency path of the incident light at the time of the transparency display which makes the field of another side the screen.

[0129]

Like drawing 7 (a), it carries out incidence of the time of the reflective display which makes the field of said another side the screen to a liquid crystal cell 11, the outdoor daylight (unpolarized light) which carried out incidence to 2nd liquid crystal display component 10B from that before side being used as the linearly polarized light S parallel to that transparency shaft 16a with the absorption polarizing plate 16 by the side of before this 2nd liquid crystal display component 10B.

[0130]

At and the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 7 (a), the linearly polarized light S which penetrated the absorption polarizing plate 16 by the side of before [said], and carried out incidence to the liquid crystal cell 11 carries out 90-degree rotatory polarization substantially, and turns into the linearly polarized light P, and the linearly polarized light P penetrates the absorption polarizing plate 17 on the backside, and carries out outgoing radiation to the backside [said 2nd liquid crystal display component 10B].

[0131]

Incidence of said linearly polarized light P which carried out outgoing radiation to the backside [said 2nd liquid crystal display component 10B] is carried out to said reflective means 20a, it is made into the linearly polarized light S which penetrated the 2nd reflective polarizing element 22, and 90 degrees of planes of vibration of said linearly polarized light P rotated substantially with aforementioned lambda / 2 phase-contrast plate 23, penetrates the light guide plate 25 of the surface light source 24, and is reflected by the 1st reflective polarizing element 21.

[0132]

Outgoing radiation of said linearly polarized light S reflected by said 1st reflective polarizing element 21 is carried out from the field which penetrates said light guide plate 25 again, is again made into the linearly polarized light P with aforementioned lambda / 2 phase-contrast plate 23, penetrates said 2nd reflective polarizing element 22, and counters 2nd liquid crystal display component 10B of said reflective means 20a, and it carries out incidence to said 2nd liquid crystal display component 10B from an after that side.

[0133]

The linearly polarized light S which carried out incidence to said 2nd liquid crystal display component 10B penetrates the absorption polarizing plate 17 on the backside [this 2nd liquid crystal display component 10B], and 90-degree rotatory polarization is substantially carried out by the liquid crystal layer 15 of a liquid crystal cell 11, and it turns into the linearly polarized light S, penetrates the absorption polarizing plate 16 by the side of before, and it carries out outgoing radiation to a before [said 2nd liquid crystal display component 10B] side.

[0134]

As shown in the right-hand side of drawing 7 (a) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 2nd liquid crystal display component 10B] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light S which carried out [the linearly polarized light] incidence from the before [2nd liquid crystal display component 10B] side, penetrated the absorption polarizing plate 16 by the side of before [that], and carried out incidence to the liquid crystal cell 11 carries out incidence to the absorption polarizing plate 17 on the backside with that polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, and is absorbed with this absorption polarizing plate 17.

[0135]

Therefore, the display at the time of the non-electric field at the time of the reflective display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of said another side is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0136]

Moreover, like the time of the transparency display which while mentioned above and makes a field the screen, the light emitting device 26 of the surface light source 24 of said reflective means 20a is turned on, and the linearly polarized light P carries out outgoing radiation of the time of the transparency display which makes the field of said another side the screen to the 1st liquid crystal display component 10A and 2nd liquid crystal display component 10B side from said reflective means 20a, respectively.

[0137]

And the linearly polarized light P which carried out outgoing radiation to the 2nd liquid crystal display component 10B side from said reflective means 20a The absorption polarizing plate 17 on the backside [this 2nd liquid crystal display component 10B] is penetrated, incidence is carried out to a liquid crystal cell 11 from an after that side, and outgoing radiation is carried out to a before [this liquid crystal cell 11] side in response to a birefringence operation of the liquid crystal layer 15 according to the orientation condition of the liquid crystal molecule which changes with the electric fields impressed to inter-electrode [of said liquid crystal cell 11].

[0138]

At namely, the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 7 (b), the linearly polarized light P which carried out incidence to said liquid crystal cell 11 from the after that side 90-degree rotatory polarization is substantially carried out by the liquid crystal layer 15, it becomes the linearly polarized light S parallel to transparency shaft 16a of the absorption polarizing plate 16 by the side of before, and outgoing radiation is carried out to a before [a liquid crystal cell 11] side, the absorption polarizing plate 16 by the side of before is penetrated, and outgoing radiation is carried out to a before [said 2nd liquid crystal display component 10B] side.

[0139]
As shown in the right-hand side of drawing 7 (b) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 2nd liquid crystal display component 10B] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light P which carried out incidence to said liquid crystal cell 11 from the after that side penetrates said liquid crystal cell 11 with that polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, carries out incidence to the absorption polarizing plate 16 by the side of before, and is absorbed with this absorption polarizing plate 16.

[0140]
Therefore, the display at the time of the non-electric field at the time of the transparency display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of said another side is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0141]
The display of this example thus, between the 1st and 2nd liquid crystal display component 10A and 10B By arranging reflective means 20a equipped with the phase contrast plate 23 to which the polarization condition of the transmitted light is changed among the reflective polarizing elements 21 and 22 of a pair At the time of the reflective display which makes the screen one field (front face of 1st liquid crystal display component 10A) The light which carried out incidence from the before [said 1st liquid crystal display component 10A] side, and penetrated this 1st liquid crystal display component 10A Make the reflective polarizing element 21 by the side of 1st [of said reflective means 20a] liquid crystal display component 10A penetrate, and it reflects by the reflective polarizing element 22 by the side of 2nd liquid crystal display component 10B. At the time of the reflective display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of another side The light which carried out incidence from the before [said 2nd liquid crystal display component 10B] side, and penetrated this 2nd liquid crystal display component 10B The reflective polarizing element 22 by the side of 2nd [of said reflective means 20a] liquid crystal display component 10B is made to penetrate, and it is made to reflect by the reflective polarizing element 21 by the side of 1st liquid crystal display component 10A.

[0142]
According to this display, the reflective polarizing elements 21 and 22 of the pair of said reflective means 20a, respectively While making it penetrate with high permeability, without reflecting with a high reflection factor, without absorbing most one linearly polarized light components between two linearly polarized light components different mutually [incident light], and absorbing most linearly polarized light components of another side Since lambda / 2 phase-contrast plate 23 arranged among the reflective polarizing elements 21 and 22 of said pair are also made to penetrate with high permeability, without absorbing most incident light, also when making which field of one side and another side into the screen, the reflective display of sufficient brightness can be performed.

[0143]
In the above-mentioned example, and the reflective polarizing elements 21 and 22 of the pair of said reflective means 20a Since each transparency shaft 21a and 22a was substantially made parallel, and is arranged and lambda / 2 phase-contrast plate 23 which gives 1/2 wave of phase contrast between Tsunemitsu, the transmitted light, and abnormality light, between them are arranged, While reflecting most linearly polarized lights P which penetrated said 1st liquid crystal display component 10A, and carried out incidence to said reflective means 20a from the field of one of these at the time of the reflective display which makes one [said] field the screen by this reflective means 20a Most linearly polarized lights S which penetrated said 2nd liquid crystal display component 10B, and carried out incidence to said reflective means 20a from the field of that another side at the time of the reflective display which makes the field of said another side the screen can be reflected by this reflective means

20a. Therefore, the indication can be given brighter also when making which field of one side and another side into the screen.

[0144]

Also in the display of this example in addition, said reflective means 20a While carrying out outgoing radiation of most incident light to the incidence side at said incidence side by one reflection by the reflective polarizing elements 22 or 21 of the opposite side In order to carry out outgoing radiation to said incidence side from the perimeter of the light which is made to carry out the multiple echo of a part of light among the reflective polarizing elements 21 and 22 of a pair, and carries out outgoing radiation of the multiple echo light by said one reflection, While enlarging outgoing radiation area of the light from the clear display section and, making said clear display section bright on the whole, the shadow of the dark display by said liquid crystal display components 10A and 10B can be abolished, and the reflective display of good quality without a twin image can be performed.

[0145]

Moreover, also in this display, since said reflective means 20a is considered as the configuration which has arranged the surface light source 24 among the reflective polarizing elements 21 and 22 of a pair, the reflective display using outdoor daylight and the transparency display using the illumination light from said surface light source 24 can be performed in both one [said] field and the field of another side, respectively.

[0146]

In addition, although each transparency shaft 21a and 22a was substantially made parallel, the reflective polarizing elements 21 and 22 of the pair of said reflective means 20a are arranged and lambda / 2 phase-contrast plate 23 is arranged among these reflective polarizing elements 21 and 22 in this example Each transparency shaft 21a and 22a is made to cross aslant at an angle of arbitration, and the reflective polarizing elements 21 and 22 of said pair are arranged. Among these reflective polarizing elements 21 and 22 A phase contrast plate with the phase contrast which changes the polarization condition of the light which penetrated and carried out incidence of one reflective polarizing element to the polarization condition reflected by the reflective polarizing element of another side may be arranged.

[0147]

Moreover, the crossed axes angle of the transparency shafts 21a and 22a of the reflective polarizing elements 21 and 22 of said pair and the phase contrast of said phase contrast plate You may set up so that light which a multiple echo is carried out among the reflective polarizing elements 21 and 22 of said pair, and carries out outgoing radiation from reflective means 20a may be made [many]. Even in such a case, by enabling it to fully secure the light which carries out outgoing radiation to the incidence side of said reflective means 20a by one reflection by the reflective polarizing element of the opposite side The dark display by cutoff of the incident light by said display devices 10A and 10B and the clear display of sufficient brightness by reflection of the transmitted light can be obtained also at the time of the reflective display which makes one [said] field the screen and a transparency display, and the reflective display which makes the field of said another side the screen, and a transparency display.

[0148]

Furthermore, what carried out the laminating of the lens sheet for giving directivity to the transmitted light is sufficient as said phase contrast plate, and by using such a lens sheet product horizon phase differential plate, it can make high the transverse-plane brightness of the light which carries out outgoing radiation to a before [a display] side, and can obtain a brighter display.

[0149]

Moreover, although said reflective means 20a is considered as the configuration which has arranged the phase contrast plate 23 between the 2nd reflective polarizing element 22 by the side of 2nd liquid crystal display component 10B, and the surface light source 24 in the above-mentioned example, said phase contrast plate 23 may be arranged between the 1st reflective polarizing element 21 by the side of 1st liquid crystal display component 10A, and said surface light source 24.

[0150]

Furthermore, although said reflective means 20a is considered as the configuration which has arranged the phase contrast plate 23 and the surface light source 24 among the reflective polarizing elements 21 and 22 of a pair in the above-mentioned example, it is good also considering the light guide plate of said surface light source 24 as a phase contrast plate.

[0151]

Drawing 8 is the decomposition perspective view of the display in which the 3rd example of this invention is shown. This example Between 1st liquid crystal display component 10A and 2nd liquid crystal display component 10B which each rear face was made to counter mutually and have been arranged at the reverse sense Reflective means 20b which comes to arrange surface light source 24a which consists of a light emitting device 26 which the light guide plate 27 which consists of a phase contrast plate, and its end face were made to counter an end face, and was prepared in them among the reflective polarizing elements 21 and 22 of a pair is arranged.

[0152]

In addition, said light guide plate 27 is used as lambda / 2 phase-contrast plate which gives 1/2 wave of phase contrast between Tsunemitsu, the transmitted light, and abnormality light in this example. Make parallel substantially each transparency shaft 21a and 22a of each other, and the reflective polarizing elements 21 and 22 of the pair of reflective means 20b are arranged. The lagging-axis 27a was substantially shifted aslant at the include angle of 45 degrees to each transparency shaft 21a and 22a of said reflective polarizing elements 21 and 22, and the light guide plate 27 which consists of the aforementioned lambda / 2 phase-contrast plate is arranged.

[0153]

Since the polarization condition of the light which penetrates between the reflective polarizing elements 21 and 22 of said pair can be changed using the light guide plate 27 of said surface light source 24a according to the display of this example, Like the 2nd example of the above, compared with the case where the phase contrast plate 23 and the surface light source 24 are arranged, the configuration of reflective means 20b can be simplified and can be thin-shape-ized among the reflective polarizing elements 21 and 22 of a pair.

[0154]

Moreover, although the polarization separation component of the pair of the reflective means 20, 20a, and 20b is used as the reflective polarizing elements 21 and 22 which consist of a reflective polarizing plate in the above 1st - the 3rd example, if said polarization separation component reflects one polarization component between two polarization components different mutually [incident light] and the polarization component of another side is made to penetrate, it will not be restricted to said reflective polarizing plate.

[0155]

Drawing 9 is the decomposition side elevation of other polarization separation components, and this polarization separation component 28 is a reflective polarizing element which one polarization component is reflected [polarizing element] between two linearly polarized light components which intersect perpendicularly mutually [incident light], and makes the polarization component of another side penetrate. Hereafter, this polarization separation component 28 is called reflective polarizing element.

[0156]

This reflective polarizing element 28 reflects one circular polarization of light component between two circular polarization of light components of the right-handed rotation and left-handed rotation of incident light, and the circular polarization of light detached core (for example, cholesteric-liquid-crystal film) 29 which makes the circular polarization of light component of another side penetrate is inserted. The laminating of the phase contrast plates 30 and 31 of the pair which carries out and carries out outgoing radiation of the circular polarization of light which made the linearly polarized light which carries out incidence the circular polarization of light, was made to carry out incidence to said circular polarization of light detached core 29, and carried out outgoing radiation from said circular polarization of light detached core 29 to the linearly polarized light is carried out.

[0157]

In addition, the phase contrast plates 30 and 31 of said pair are lambda / 4 phase-contrast plate which gives the phase contrast of quarter-wave length between Tsunemitsu, the transmitted light, and abnormality light, respectively, and these phase contrast plates 30 and 31 make each lagging axis intersect perpendicularly mutually substantially, and are arranged.

[0158]

The inside of two directions where 45 degrees of this reflective polarizing element 28 shifted substantially to the lagging axis of lambda / 4 phase-contrast plates 30 and 31 of said pair and which intersect perpendicularly mutually, In one direction, for example, drawing, the lagging axis of the upper phase differential plate (henceforth a top phase contrast plate) 30 is received. It has a transparency shaft in the direction which saw from the bottom (external surface side of the top phase contrast plate 30), and shifted in the clockwise direction 45 degrees. It gets down. the direction of another side which intersects perpendicularly with it (direction which saw from the bottom and shifted in the counterclockwise direction 45 degrees to the lagging axis of the bottom phase differential plate 31) -- a reflective shaft -- **** -- The linearly polarized light component of another side in which the linearly polarized light component was reflected in and while it had a plane of vibration parallel to said reflective shaft between two linearly polarized light components which intersect perpendicularly mutually [the incident light of incident light] had a plane of vibration parallel to said transparency shaft is made to penetrate.

[0159]

This reflective polarizing element 28 the linearly polarized light S parallel to said reflective shaft among the light which carried out incidence from the bottom in the field side of one of these, for example, drawing, namely, with said top phase contrast plate 30 Incidence is carried out to said circular polarization of light detached core 29 as the clockwise circular polarization of light R1 toward the travelling direction (it sets to drawing and is down) of light. The linearly polarized light P parallel to said transparency shaft with said top phase contrast plate 30 While carrying out incidence to said circular polarization of light detached core 29 as the counterclockwise circular polarization of light R2 toward the travelling direction of light The linearly polarized light S parallel to said reflective shaft among the light which carried out incidence from the bottom in the field side of another side, i.e., drawing, with said bottom phase contrast plate 31 Incidence is carried out to said circular polarization of light detached core 29 as the clockwise circular polarization of light R1 toward the travelling direction (it sets to drawing and is above) of light, and incidence of the linearly polarized light P parallel to said transparency shaft is carried out to said circular polarization of light detached core 29 as the counterclockwise circular polarization of light R2 toward the travelling direction of light with said bottom phase contrast plate 31.

[0160]

In addition, although the hand of cut (sense of an arrow head) of said circular polarization of lights R1 and R2 is unified in the direction seen from the bottom in drawing and drawing 9 shows it for convenience The direction as drawing where the hand of cut seen from the direction which goes to the travelling direction of the circular polarization of lights R1 and R2 which go to the bottom from the bottom in drawing among these circular polarization of lights R1 and R2 is the same, The hand of cut seen from the direction which goes to the travelling direction of the circular polarization of lights R1 and R2 of the light which goes to the bottom from the bottom in drawing is a direction contrary to drawing.

[0161]

On the other hand, also to the light which carried out incidence from which [of the one side and another side] field side, the circular polarization of light detached core 29 reflects a clockwise circular polarization of light component toward the travelling direction, and has the polarization separation property of making a counterclockwise circular polarization of light component penetrating.

[0162]

Therefore, the light which considered as the clockwise circular polarization of light R1 toward the travelling direction among the light which carried out incidence from the bottom in drawing with said top phase contrast plate 30, and carried out incidence to said circular polarization of light detached core 29 Are reflected by this circular polarization of light detached core 29, and it turns outgoing radiation up, that reflected light R1 being used as the linearly polarized light S parallel to said reflective shaft with said top phase contrast plate 30. It turns outgoing radiation down, the light which considered as the counterclockwise circular polarization of light R2 toward the travelling direction with said top phase contrast plate 30, and carried out incidence to said circular polarization of light detached core 29 penetrating this circular polarization of light detached core 29, carrying out incidence to the bottom phase contrast plate 31, and being used as the linearly polarized light P parallel to said transparency shaft with this bottom phase contrast plate 31.

[0163]

Moreover, the light which considered as the clockwise circular polarization of light R1 toward the travelling direction among the light which carried out incidence from the bottom in drawing with said bottom phase contrast plate 31, and carried out incidence to said circular polarization of light detached core 29 Are reflected by this circular polarization of light detached core 29, and it turns outgoing radiation down, that reflected light R1 being used as the linearly polarized light S parallel to said reflective shaft with said bottom phase contrast plate 31. It turns outgoing radiation up, the light which considered as the counterclockwise circular polarization of light R2 toward the travelling direction with said bottom phase contrast plate 31, and carried out incidence to said circular polarization of light detached core 29 penetrating this circular polarization of light detached core 29, carrying out incidence to the top phase contrast plate 30, and being used as the linearly polarized light P parallel to said transparency shaft with this top phase contrast plate 30.

[0164]

Thus, the inside of two linearly polarized light components components and said reflective polarizing element 28 cross at right angles mutually [incident light], It is the thing which makes the polarization component of another side in which the polarization component was reflected in and while it had a plane of vibration parallel to said reflective shaft had a plane of vibration parallel to said transparency shaft penetrate. Therefore, even if it replaces with the reflective polarizing elements (reflective polarizing plate) 21 and 22 of the pair of the reflective means 20, 20a, and 20b in each example mentioned above and uses this reflective polarizing element 28, the same effectiveness as each example can be acquired.

[0165]

Drawing 10 - drawing 12 show the 4th example of this invention, and drawing 10 is the mimetic diagram showing the transparency path of the time of the decomposition perspective view, drawing 11 , and drawing 12 of a display making one field of said display the screen, and the incident light when making the field of another side into the screen.

[0166]

As shown in drawing 10 , the display of this example between the 1st [which each rear face was made to counter mutually and has been arranged at the reverse sense], and 2nd liquid crystal display component 10A and 10B The circular polarization of light detached core 34 which one circular polarization of light component is reflected [detached core] between two circular polarization of light components of the right-handed rotation and left-handed rotation of incident light, and makes the circular polarization of light component of another side penetrate, It is arranged at one field side of said circular polarization of light detached core 34, make into the circular polarization of light the linearly polarized light which carried out incidence to the field which counters said circular polarization of light detached core 34 from the opposite side, and incidence is carried out to said circular polarization of light detached core 34. It has the polarization separation components 32 and 33 of a pair which consist of a phase contrast plate 35 which makes the circular polarization of light which carried out outgoing radiation from said circular polarization of light detached core 34 the linearly polarized light, and carries out outgoing radiation from said opposite side, and reflective means 20c of a configuration of having had the surface light source 24 among these polarization separation components 32 and 33 is arranged.

[0167]

In addition, in this example, since said 1st liquid crystal display component 10A and 2nd liquid crystal display component 10B are the TN liquid crystal display devices of the same configuration as the thing of the 1st example fundamentally mentioned above and the surface light source 24 of said reflective means 20c is also the same configuration as the thing of the 1st example, that explanation attaches and omits a same sign to drawing.

[0168]

In this example, the circular polarization of light detached cores 34 of the polarization separation components 32 and 33 of the pair of said reflective means 20c are lambda / 4 phase-contrast plate with which the phase contrast plate 35 which is a cholesteric-liquid-crystal film and has been arranged at one field side of said circular polarization of light detached core 34 gives the phase contrast of quarter-wave length between Tsunemitsu, the transmitted light, and abnormality light.

[0169]

The inside of the polarization component from which the polarization separation components 32 and 33 of said pair differ mutually [incident light], respectively, It is the thing which one polarization component is reflected [thing] and makes the polarization component of another side penetrate. Incidence is carried out to the circular polarization of light detached core 34 as the surrounding circular polarization of light. the linearly polarized light in which while was prepared and lambda / 4 phase-contrast plate 35 carried out incidence from the field side -- aforementioned lambda / 4 phase-contrast plate 35 -- one of right and left -- While carrying out incidence of the light which carried out incidence from the field, i.e., external surface of circular polarization of light detached core 34, side of another side to said circular polarization of light detached core 34 as it is The inside of the circular polarization of light reflected by said circular polarization of light detached core 34 and the circular polarization of light which penetrated said circular polarization of light detached core 34, Outgoing radiation of the circular polarization of light which carried out outgoing radiation to the external surface side of said circular polarization of light detached core 34 is carried out as it is, and outgoing radiation of the circular polarization of light which carried out outgoing radiation to the field side in which lambda / 4 phase-contrast plate 35 of said circular polarization of light detached core 34 were formed is carried out as the linearly polarized light with aforementioned lambda / 4 phase-contrast plate 35.

[0170]

The circular polarization of light detached core 34 of the polarization separation component 32 by the side of 1st liquid crystal display component 10A (henceforth the 1st polarization separation component) among the polarization separation components 32 and 33 of said pair A clockwise circular polarization of light component is reflected from which [of the one side and another side] field side toward the travelling direction also to the light which carried out incidence. It has the polarization separation property of making a counterclockwise circular polarization of light component penetrating. lambda / 4 phase-contrast plate 35 of this 1st polarization separation component 32 The sense of lagging-axis 35a of this lambda / 4 phase-contrast plate 35 is set up, and it is arranged so that the linearly polarized light which carried out outgoing radiation to the backside [said 1st liquid crystal display component 10A] may be changed to the circular polarization of light R2 of the left-handed rotation which penetrates said circular polarization of light detached core 34 and may carry out incidence to said circular polarization of light detached core 34.

[0171]

Moreover, the circular polarization of light detached core 34 of the polarization separation component 33 by the side of 2nd liquid crystal display component 10B (henceforth the 2nd polarization separation component) Also as opposed to the light which carried out incidence from the polarization separation property [that the circular polarization of light detached core 34 of said 1st polarization separation component 33 is reverse], i.e., which [of one side and another side] field, side A counterclockwise circular polarization of light component is reflected toward that travelling direction, and it has the property of making a clockwise circular polarization of light component penetrating. lambda / 4 phase-contrast plate 35 of this 2nd polarization separation component 33 The sense of lagging-axis 35a of this lambda / 4 phase-contrast plate 35 is set up, and it is arranged so that the linearly polarized light which carried out outgoing radiation to the backside [said 2nd liquid crystal display component 10B] may be changed to the circular polarization of light R1 of the right-handed rotation which penetrates said circular polarization of light detached core 34 and may carry out incidence to said circular polarization of light detached core 34.

[0172]

In addition, although the hand of cut (sense of an arrow head) of said circular polarization of lights R1 and R2 is unified in the direction seen from the bottom in drawing and drawing 11 and drawing 12 show it for convenience The direction as drawing where the hand of cut seen from the direction which goes to the travelling direction of the circular polarization of lights R1 and R2 which go to the bottom from the bottom in drawing among these circular polarization of lights R1 and R2 is the same, The hand of cut seen from the direction which goes to the travelling direction of the circular polarization of lights R1 and R2 of the light which goes to the bottom from the bottom in drawing is a direction contrary to drawing.

[0173]

Like drawing 10 , the polarization separation components 32 and 33 of said pair make lagging-axis 35a of each lambda / 4 phase-contrast plate 35 intersect perpendicularly mutually substantially, and are arranged while making each circular polarization of light detached core 34 counter mutually.

[0174]

Said reflective means 20c and the linearly polarized light which carried out outgoing radiation to the backside [said 1st liquid crystal display component 10A] Incidence is carried out to the circular polarization of light detached core 34 of this 1st polarization separation component 32 as the circular polarization of light R2 of said left-handed rotation with lambda / 4 phase-contrast plate 35 of said 1st polarization separation component 32. The linearly polarized light which carried out outgoing radiation to the backside [said 2nd liquid crystal display component 10B] so that incidence may be carried out to the circular polarization of light detached core 34 of this 2nd polarization separation component 33 as the circular polarization of light R2 of said left-handed rotation with lambda / 4 phase-contrast plate 35 of said 2nd polarization separation component 33 See lagging-axis 35a of lambda / 4 phase-contrast plate 35 of said 1st polarization separation component 32 from a before side to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 1st liquid crystal display component 1], and it turns in the counterclockwise direction in the 45-degree direction substantially. Lagging-axis 35a of lambda / 4 phase-contrast plate 35 of said 2nd polarization separation component 33 is seen from a before side to transparency shaft 17a of the absorption polarizing plate 17 on the backside [said 2nd liquid crystal display component 1], and it is substantially arranged towards the 45-degree direction in the counterclockwise direction.

[0175]

If the transparency path of the incident light when making one field (front face of 1st liquid crystal display component 10A) of a reflective display of this display into the screen is explained, drawing 11 (a) shows the transparency path of the incident light at the time of the reflective display which makes one field the screen, and drawing 11 (b) shows the transparency path of the incident light at the time of the transparency display which makes one field the screen.

[0176]

Like drawing 11 (a), it carries out incidence of the time of the reflective display which makes one [said] field the screen to a liquid crystal cell 11, the outdoor daylight (unpolarized light) which carried out incidence to 1st liquid crystal display component 10A from that before side being used as the linearly polarized light S parallel to that transparency shaft 16a with the absorption polarizing plate 16 by the side of before this 1st liquid crystal display component 10A.

[0177]

At and the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 11 (a), said linearly polarized light S which carried out incidence to said liquid crystal cell 11 It becomes the linearly polarized light P parallel to transparency shaft 17a of the absorption polarizing plate 17 on the backside, and the absorption polarizing plate 17 on said backside is penetrated, outgoing radiation is carried out [90 degree rotatory polarization is substantially carried out by the liquid crystal layer 15,] to the backside [said 1st liquid crystal display component 10A], and incidence is carried out to said reflective means 20c.

[0178]

It carries out incidence to the circular polarization of light detached core 34, the linearly polarized light P which carried out incidence to said reflective means 20c being used as the counterclockwise circular polarization of light R2 toward a travelling direction with lambda / 4 phase-contrast plate 35 of the 1st polarization separation component 32 of this reflective means 20c, and it penetrates this circular polarization of light detached core 34, and it carries out outgoing radiation to the backside [said 1st polarization separation component 32].

[0179]

The light guide plate 25 of the surface light source 24 is penetrated, and it is reflected by the circular polarization of light detached core 34 of the polarization separation component 33 of the 2nd polarization separation component 33, and the reflected light R2 penetrates again the light guide plate 25 of said surface light source 24, and carries out re-incidence of the circular polarization of light R2 of the left-handed rotation which carried out outgoing radiation to the backside [said 1st polarization separation component 32] to said 1st polarization separation component 32 from an after that side.

[0180]

Said circular polarization of light R2 which carried out re-incidence to said 1st polarization separation component 32 from the after that side penetrates the circular polarization of light detached core 34 of this 1st polarization separation component 32, it carries out outgoing radiation to the 1st liquid crystal display component 10A side, being further used as the linearly polarized light P with lambda / 4 phase-contrast plate 35, and it penetrates again said 1st liquid crystal display component 10A, and it carries out outgoing radiation to that before side.

[0181]

At the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 1st liquid crystal display component 10A] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 3 or 4th page of a substrate As shown in the right-hand side of drawing 11 (a), incidence is carried out from a before [1st liquid crystal display component 10A] side. The linearly polarized light S which penetrated the absorption polarizing plate 16 by the side of before [the], and carried out incidence to the liquid crystal cell 11 penetrates said liquid crystal cell 11 with the polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, incidence is carried out to the absorption polarizing plate 17 on the backside, and most of the light is absorbed with the absorption polarizing plate 17 on said backside.

[0182]

Therefore, the display at the time of the non-electric field at the time of the reflective display which makes the screen one [said] field (front face of 1st liquid crystal display component 10A) is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0183]

Moreover, the light emitting device 26 of the surface light source 24 of said reflective means 20c is turned on, and the outgoing radiation light from said light emitting device 26 carries out outgoing radiation of the time of the transparency display which makes one [said] field the screen from the field of one side of a light guide plate 25, and another side like drawing 11 (b).

[0184]

And incidence of the illumination light which carried out outgoing radiation from the field which counters the 1st polarization separation component 32 of said light guide plate 25 is carried out to the circular polarization of light detached core 34 of said 1st polarization separation component 32, a clockwise circular polarization of light component is reflected by said circular polarization of light detached core 34 toward a travelling direction among the light (unpolarized light), and a counterclockwise circular polarization of light component penetrates said circular polarization of light detached core 34. It carries out outgoing radiation to the 1st liquid crystal display component 10A side, the circular polarization of light R2 of the left-handed rotation which penetrated this circular polarization of light detached core 34 being used as the linearly polarized light P with lambda / 4 phase-contrast plate 35.

[0185]

The circular polarization of light R1 of the right-handed rotation reflected by the circular polarization of light detached core 34 of said 1st polarization separation component 32 among the light which carried out outgoing radiation on the other hand from the field which counters the 1st polarization separation component 32 of said light guide plate 25 While penetrating said light guide plate 25 and penetrating the circular polarization of light detached core 34 of the 2nd polarization separation component 33 further, it considers as the linearly polarized light S with lambda / 4 phase-contrast plate 35, and outgoing radiation is carried out to the 2nd liquid crystal display component 10B side.

[0186]

Moreover, incidence of the illumination light which carried out outgoing radiation from the field which counters the 2nd polarization separation component 33 of said light guide plate 25 is carried out to the circular polarization of light detached core 34 of said 2nd polarization separation component 33, a counterclockwise circular polarization of light component is reflected by said circular polarization of light detached core 34 toward a travelling direction among the light (unpolarized light), and a clockwise circular polarization of light component penetrates said circular polarization of light detached core 34. It carries out outgoing radiation to the 2nd liquid crystal display component 10B side, the circular polarization of light R1 of the right-handed rotation which penetrated this circular polarization of light detached core 34 being used as the linearly polarized light S with lambda / 4 phase-contrast plate 35.

[0187]

The circular polarization of light R2 of the left-handed rotation reflected by the circular polarization of light detached core 34 of said 2nd polarization separation component 33 among the light which carried out outgoing radiation on the other hand from the field which counters the 2nd polarization separation component 33 of said light guide plate 25 While penetrating said light guide plate 25 and penetrating the circular polarization of light detached core 34 of the 1st polarization separation component 32 further, it considers as the linearly polarized light P with lambda / 4 phase-contrast plate 35, and outgoing radiation is carried out to the 1st liquid crystal display component 10A side.

[0188]

namely, abbreviation abbreviation and said reflective means 20c cross at right angles mutually the illumination light from said surface light source 24 -- it separates into the two linearly polarized lights P and S of the same reinforcement, outgoing radiation of one linearly polarized light P is carried out to the 1st liquid crystal display component 10A side, and outgoing radiation of the linearly polarized light S of another side is carried out to the 2nd liquid crystal display component 10B side.

[0189]

And the linearly polarized light P which carried out outgoing radiation to the 1st liquid crystal display component 10A side from said reflective means 20c The absorption polarizing plate 17 on the backside [this 1st liquid crystal display component 10A] is penetrated, incidence is carried out to a liquid crystal cell 11 from an after that side, and outgoing radiation is carried out to a before [this liquid crystal cell 11] side in response to a birefringence operation of the liquid crystal layer 15 according to the orientation condition of the liquid crystal molecule which changes with the electric fields impressed to inter-electrode [of said liquid crystal cell 11].

[0190]

At namely, the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 11 (b), the linearly polarized light P which carried out incidence to said liquid crystal cell 11 from the after that side 90-degree rotatory polarization is substantially carried out according to a birefringence operation of the liquid crystal layer 15, and it becomes the linearly polarized light S, and the linearly polarized light S penetrates the absorption polarizing plate 16 by the side of before, and carries out outgoing radiation to a before [said 1st liquid crystal display component 10A] side.

[0191]

As shown in the right-hand side of drawing 11 (b) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 1st liquid crystal display component 10A] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light P which carried out incidence to said liquid crystal cell 11 from the after that side carries out incidence to the absorption polarizing plate 16 by the side of before with the polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, and most of the light is absorbed with the absorption polarizing plate 16 by the side of before [said].

[0192]

Therefore, the display at the time of the non-electric field at the time of the transparency display which makes the screen one [said] field (front face of 1st liquid crystal display component 10A) is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0193]

Next, if the transparency path of the incident light when making the field of another side into the screen is explained, drawing 12 (a) shows the transparency path of the incident light at the time of the reflective display which makes the field of another side the screen, and drawing 12 (b) shows the transparency path of the incident light at the time of the transparency display which makes the field of another side the screen.

[0194]

Like drawing 12 (a), it carries out incidence of the time of the reflective display which makes the field of said another side the screen to a liquid crystal cell 11, the outdoor daylight (unpolarized light) which carried out incidence to 2nd liquid crystal display component 10B from that before side being used as the linearly polarized light P parallel to that transparency shaft 16a with the absorption polarizing plate 16 by the side of before this 2nd liquid crystal display component 10B.

[0195]

At and the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 12 (a), the linearly polarized light P which penetrated the absorption polarizing plate 16 by the side of before [said], and carried out incidence to the liquid crystal cell 11 carries out 90-degree rotatory polarization substantially, and turns into the linearly polarized light S, and the linearly polarized light S penetrates the absorption polarizing plate 17 on the backside, and carries out outgoing radiation to the backside [said 2nd liquid crystal display component 10B].

[0196]
Said linearly polarized light S which carried out outgoing radiation to the backside [said 2nd liquid crystal display component 10B] Incidence is carried out to said reflective means 20c. With lambda / 4 phase-contrast plate 35 of the 2nd polarization separation component 33 of this reflective means 20c It considers as the clockwise circular polarization of light R1 toward a travelling direction, and incidence is carried out to the circular polarization of light detached core 34, this circular polarization of light detached core 34 is penetrated, and outgoing radiation is carried out to the backside [said 2nd polarization separation component 33].

[0197]
The light guide plate 25 of the surface light source 24 is penetrated, and it is reflected by the circular polarization of light detached core 34 of the 1st polarization separation component 32, and the reflected light R1 penetrates again the light guide plate 25 of said surface light source 24, and carries out re-incidence of the circular polarization of light R1 of the right-handed rotation which carried out outgoing radiation to the backside [said 2nd polarization separation component 33] to said 2nd polarization separation component 33 from an after that side.

[0198]
Said circular polarization of light R1 which carried out re-incidence to said 2nd polarization separation component 33 from the after that side The circular polarization of light detached core 34 of this 2nd polarization separation component 33 is penetrated. Further with lambda / 4 phase-contrast plate 35 It is returned to the same linearly polarized light P as the light which carried out outgoing radiation to the backside [said 2nd liquid crystal display component 10B] and which carried out incidence to reflective means 20c, and outgoing radiation is carried out to the 1st liquid crystal display component 10A side, said 1st liquid crystal display component 10A is penetrated again, and outgoing radiation is carried out to the before side.

[0199]
As shown in the right-hand side of drawing 12 (a) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 2nd liquid crystal display component 10B] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light S which carried out [the linearly polarized light] incidence from the before [2nd liquid crystal display component 10B] side, penetrated the absorption polarizing plate 16 by the side of before [that], and carried out incidence to the liquid crystal cell 11 carries out incidence to the absorption polarizing plate 17 on the backside with that polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, and is absorbed with this absorption polarizing plate 17.

[0200]
Therefore, the display at the time of the non-electric field at the time of the reflective display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of said another side is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0201]
Moreover, like the time of the transparency display which while mentioned above and makes a field the screen, the light emitting device 26 of the surface light source 24 of said reflective means 20c is turned on, the linearly polarized light P carries out outgoing radiation of the time of the transparency display which makes the field of said another side the screen to the 1st liquid crystal display component 10A side from said reflective means 20c, and the linearly polarized light S carries out outgoing radiation to the 2nd liquid crystal display component 10B side.

[0202]
And the linearly polarized light S which carried out outgoing radiation to the 2nd liquid crystal display

component 10B side from said reflective means 20c The absorption polarizing plate 17 on the backside [this 2nd liquid crystal display component 10B] is penetrated, incidence is carried out to a liquid crystal cell 11 from an after that side, and outgoing radiation is carried out to a before [this liquid crystal cell 11] side in response to a birefringence operation of the liquid crystal layer 15 according to the orientation condition of the liquid crystal molecule which changes with the electric fields impressed to inter-electrode [of said liquid crystal cell 11].

[0203]

At namely, the time of the non-electric field which do not impress electric field to inter-electrode [of said liquid crystal cell 11] (V= 0) As shown in the left-hand side of drawing 12 (b), the linearly polarized light S which carried out incidence to said liquid crystal cell 11 from the after that side 90-degree rotatory polarization is substantially carried out by the liquid crystal layer 15, it becomes the linearly polarized light P parallel to transparency shaft 16a of the absorption polarizing plate 16 by the side of before, and outgoing radiation is carried out to a before [a liquid crystal cell 11] side, the absorption polarizing plate 16 by the side of before is penetrated, and outgoing radiation is carried out to a before [said 2nd liquid crystal display component 10B] side.

[0204]

As shown in the right-hand side of drawing 12 (b) at the time (V>Vth) of the electric-field impression which, on the other hand, impressed the electric field which it starts [electric field] to inter-electrode [of the liquid crystal cell 11 of said 2nd liquid crystal display component 10B] perpendicularly substantially, and carry out orientation of the liquid crystal molecule to it to the 12 or 13th page of a substrate The linearly polarized light S which carried out incidence to said liquid crystal cell 11 from the after that side penetrates said liquid crystal cell 11 with that polarization condition, without receiving a birefringence operation of the liquid crystal layer 15, carries out incidence to the absorption polarizing plate 16 by the side of before, and is absorbed with this absorption polarizing plate 16.

[0205]

Therefore, the display at the time of the non-electric field at the time of the transparency display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of said another side is clear display (coloring display), and the display at the time (V>Vth) of electric-field impression is a dark display (black display).

[0206]

The display of this example thus, between the 1st and 2nd liquid crystal display component 10A and 10B The circular polarization of light detached core 34 which one circular polarization of light component is reflected [detached core] between two circular polarization of light components of the right-handed rotation and left-handed rotation of incident light, and makes the circular polarization of light component of another side penetrate, It is arranged at one field side of said circular polarization of light detached core 34, make into the circular polarization of light the linearly polarized light which carried out incidence to the field which counters said circular polarization of light detached core 34 from the opposite side, and incidence is carried out to said circular polarization of light detached core 34. By arranging reflective means 20a which each circular polarization of light detached core 34 was opposed mutually, and has arranged the polarization separation components 32 and 33 of a pair which consist of lambda / a 3 phase-contrast plate 35 which makes the circular polarization of light which carried out outgoing radiation from said circular polarization of light detached core 34 the linearly polarized light, and carries out outgoing radiation from said opposite side At the time of the reflective display which makes the screen one field (front face of 1st liquid crystal display component 10A) The light which carried out incidence from the before [said 1st liquid crystal display component 10A] side, and penetrated this 1st liquid crystal display component 10A Make the polarization separation component 32 by the side of 1st [of said reflective means 20c] liquid crystal display component 10A penetrate, and it reflects by the polarization separation component 33 by the side of 2nd liquid crystal display component 10B. At the time of the reflective display which makes the screen the field (front face of 2nd liquid crystal display component 10B) of another side The light which carried out incidence from the before [said 2nd liquid crystal display component 10B] side, and penetrated this 2nd liquid crystal display component 10B The polarization separation component 33 by the side of 2nd [of said reflective means 20a] liquid crystal display component 10B is made to penetrate, and it is made to reflect by the polarization separation component 32 by the side of 1st liquid crystal display component 10A.

[0207]

According to this display, it reflects with a high reflection factor, without the polarization separation components 32 and 22 of the pair of said reflective means 20a absorbing most one polarization components between two polarization components different mutually [incident light], respectively, and since it is made to penetrate with high permeability, without absorbing most polarization components of another side, also when making which field of one side and another side into the screen, the reflective display of sufficient brightness can be performed.

[0208]

In the display of this example, and the inside of the polarization separation components 32 and 22 of the pair of said reflective means 20c, The circular polarization of light detached core 34 of one polarization separation component 32 reflects a clockwise circular polarization of light component. Since it has the polarization separation property of making a counterclockwise circular polarization of light component penetrating and has the polarization separation property that the circular polarization of light detached core 34 of the polarization separation component 33 of another side reflects a counterclockwise circular polarization of light component, and makes a clockwise circular polarization of light component penetrate, While reflecting most light which penetrated said 1st liquid crystal display component 10A, and carried out incidence to said reflective means 20c from the field of one of these at the time of the reflective display which makes one [said] field the screen by this reflective means 20c Most light which penetrated said 2nd liquid crystal display component 10B, and carried out incidence to said reflective means 20c from the field of that another side at the time of the reflective display which makes the field of said another side the screen can be reflected by this reflective means 20c. Therefore, the indication can be given brighter also when making which field of one side and another side into the screen.

[0209]

Also in the display of this example in addition, said reflective means 20c While carrying out outgoing radiation of most incident light to the incidence side at said incidence side by one reflection by the polarization separation components 33 or 32 of the opposite side In order to carry out outgoing radiation to said incidence side from the perimeter of the light which is made to carry out the multiple echo of a part of light among the polarization separation components 32 and 22 of a pair, and carries out outgoing radiation of the multiple echo light by said one reflection, While enlarging outgoing radiation area of the light from the clear display section and, making said clear display section bright on the whole, the shadow of the dark display by said liquid crystal display components 10A and 10B can be abolished, and the reflective display of good quality without a twin image can be performed.

[0210]

Moreover, also in this display, since said reflective means 20a is considered as the configuration which has arranged the surface light source 24 among the polarization separation components 32 and 22 of a pair, the reflective display using outdoor daylight and the transparency display using the illumination light from said surface light source 24 can be performed in both one [said] field and the field of another side, respectively.

[0211]

In addition, although the display of the 1st - the 4th example mentioned above gives both the display which makes one field the screen, and an indication which makes the field of another side the screen no MARI White mode This invention is applicable also to the display which gave both the display which makes one [said] field the screen, and both [one side or] which make the field of said another side the screen the NOMA reeve rack mode in which the display at the time of non-electric field was a dark display.

[0212]

Moreover, although the display of each above-mentioned example uses the 1st and the 2nd display device 10A and 10B as the liquid crystal display component of TN mold, respectively Said display devices 10A and 10B Not only TN mold but a STN mold, a non-twisting homogeneous orientation mold, It is good also as a liquid crystal display component of a mold which liquid crystal display components, such as a homeotropic orientation mold, a horizontal electric-field mold, strong dielectricity or an antiferroelectric mold, and an ECB (birefringence effectiveness) mold, are sufficient as, and is different in said the 1st, one side of the 2nd display device 10A and 10B, and another side.

[0213]

Moreover, said the 1st and 2nd display device 10A and 10B Are good also as a monochrome display component which is not equipped with a color filter for the one side or both. In that case While using both display devices 10A and 10B as a monochrome display component and writing red, green, and blue monochrome image data in said display devices 10A and 10B one by one at the time of a transparency display It may be made to perform the field sequential display which carries out outgoing radiation of red, green, and the blue coloring light one by one from the reflective means 20, 20a, 20b, and 20c.

[0214]

Furthermore, as long as said the 1st and 2nd display device 10A and 10B control transparency and cutoff of incident light, display devices other than a liquid crystal display component are sufficient as them.

[0215]

Moreover, the reflective display which uses outdoor daylight also when the display of each above-mentioned example makes the reflective means 20, 20a, 20b, and 20c equipped with the surface light sources 24 and 24a and one field is made into the screen, and also when making the field of another side into the screen, Although it enables it to display both transparency displays using the illumination light from said surface light sources 24 and 24a It is good only as for a reflective display in the display which omits the surface light sources 24 and 24a from said reflective means 20, 20a, 20b, and 20c, and makes one field the screen, and the display which makes the field of another side the screen.

[0216]

[Effect of the Invention]

The display of this invention makes each rear face counter mutually, and arranges the 1st and the 2nd display device which control transparency and cutoff of the light which carried out incidence from the side before being the observation side of a display to the reverse sense. Between said the 1st and 2nd display device One polarization component is reflected between two polarization components different mutually [incident light]. Have the polarization separation component of the pair which makes the polarization component of another side penetrate, and the light of the polarization component which penetrated the polarization separation component of one of these is reflected by the polarization separation component of another side. Since a reflective means to reflect the light of the polarization component which penetrated the polarization separation component of said another side by one [said] reflective polarizing element is arranged, also when making which field of one side and another side into the screen, the reflective display of sufficient brightness can be performed.

[0217]

In the display of this invention the reflective polarizing element of the pair of said reflective means When it is desirable to make each transparency shaft cross mutually and to arrange it and it does in this way At the time of the reflective display given the screen, one field (front face of the 1st display device) While reflecting with said reflective means and carrying out outgoing radiation of the light which penetrated the 1st display device and penetrated the reflective polarizing element by the side of this 1st display device to a before [said 1st display device] side At the time of the reflective display given the screen, the field (front face of the 2nd display device) of another side Reflect with said reflective means and outgoing radiation of the light which penetrated the 2nd display device and penetrated the reflective polarizing element by the side of this 2nd display device is carried out to a before [said 2nd display device] side. The display of sufficient brightness by reflection of the transmitted light can be obtained also at the time of the reflective display which makes one [said] field the screen, and the reflective display which makes the field of said another side the screen.

[0218]

In the display of this invention the polarization separation component of the pair of said reflective means, respectively The inside of two linearly polarized light components which have a transparency shaft and a reflective shaft in the direction which intersects perpendicularly mutually, and intersect perpendicularly mutually [incident light], The reflective polarizing element which makes the linearly polarized light component of another side in which the linearly polarized light component was reflected in and while it had a plane of vibration parallel to said reflective shaft had a plane of vibration parallel to said transparency shaft penetrate is desirable. In that case, the reflective polarizing element of said pair [whether each transparency shaft is made for said reflective means to cross mutually, and it arranges and] Or the display of brightness sufficient also at the time of the reflective display which makes one field the screen, and the reflective display which makes the field of another side the screen can be obtained by considering as the configuration which has arranged further the phase contrast plate to which the polarization condition of the transmitted light is changed between the reflective polarizing elements of said pair.

[0219]

After countering a near substrate and a before [this] side substrate in the display of this invention before being the observation side of a display, said the 1st and 2nd display device moreover, between side substrates The liquid crystal cell in which the liquid crystal layer which controls the polarization condition of the transmitted light according to the electric field impressed was prepared is pinched. Before and after that The inside of two linearly polarized light components which have a transparency shaft and an absorption shaft in the direction which intersects perpendicularly mutually, and intersect perpendicularly mutually [incident light], When considering as the liquid crystal display component by which the absorption polarizing plate of the pair which absorb the light of a polarization component, and while it is parallel to said absorption shaft is parallel to said transparency shaft, and also makes the polarization component of a way penetrate has been arranged, The reflective polarizing element by the side of said 1st liquid crystal display component among the reflective polarizing elements of the pair of said reflective means The transparency shaft of the absorption polarizing plate on the backside [said 1st liquid crystal display component] is substantially set as the transparency shaft at parallel, and it is arranged. The reflective polarizing element by the side of said 2nd liquid crystal display component When it is desirable to set substantially the transparency shaft of the absorption polarizing plate on the backside [said 2nd display device] as the transparency shaft at parallel, and to arrange it and it does in this way The indication can be given brighter also at the time of the reflective display which makes one field the screen, and the reflective display which makes the field of another side the screen.

[0220]

In the display of this invention furthermore, said reflective means The circular polarization of light detached core which one circular polarization of light component is reflected [detached core] between two circular polarization of light components of the right-handed rotation and left-handed rotation of incident light, and makes the circular polarization of light component of another side penetrate, It is arranged at one field side of said circular polarization of light detached core, make into the circular polarization of light the linearly polarized light which carried out incidence to the field which counters said circular polarization of light detached core from the opposite side, and incidence is carried out to said circular polarization of light detached core. It has the polarization separation component of a pair which consists of a phase contrast plate which makes the circular polarization of light which carried out outgoing radiation from said circular polarization of light detached core the linearly polarized light, and carries out outgoing radiation from said opposite side. By being good also as a configuration which said each circular polarization of light detached core was opposed mutually, and has arranged it, and considering these polarization separation components as such a configuration The display of brightness sufficient also at the time of the reflective display which makes one field the screen, and the reflective display which makes the field of another side the screen can be obtained.

[0221]

In the display of this invention moreover, said reflective means The light guide plate which is made to penetrate the light which carried out incidence from the field of one side and another side, respectively, and carries out outgoing radiation of the incident light from an end face from one [at least] field of said one side and another side between the polarization separation components of said pair, When considering as the configuration arranged further is desirable and it carries out the surface light source which consists of a light emitting device which was made to counter said end face of this light guide plate, and was prepared in this way The reflective display using outdoor daylight and the transparency display using the illumination light from said surface light source can be performed in both one [said] field and the field of another side, respectively.

[Brief Description of the Drawings]

[Drawing 1] The decomposition perspective view of the display in which the 1st example of this invention is shown.

[Drawing 2] The mimetic diagram showing the transparency path of the incident light when making one field of the display of the 1st example into the screen.

[Drawing 3] The mimetic diagram showing the transparency path of the incident light when making the field of another side of the display of the 1st example into the screen.

[Drawing 4] The perspective view showing an example of the electronic equipment which had a display in both sides.

[Drawing 5] The decomposition perspective view of the display in which the 2nd example of this invention is shown.

[Drawing 6] The mimetic diagram showing the transparency path of the incident light when making one field of the display of the 2nd example into the screen.

[Drawing 7] The mimetic diagram showing the transparency path of the incident light when making the field of another side of the display of the 2nd example into the screen.

[Drawing 8] The decomposition perspective view of the display in which the 3rd example of this invention is shown.

[Drawing 9] The decomposition side elevation of other polarization separation components.

[Drawing 10] The decomposition perspective view of the display in which the 4th example of this invention is shown.

[Drawing 11] The mimetic diagram showing the transparency path of the incident light when making one field of the display of the 4th example into the screen.

[Drawing 12] The mimetic diagram showing the transparency path of the incident light when making the field of another side of the display of the 4th example into the screen.

[Description of Notations]

10A, 10B -- Liquid crystal display component
11 -- Liquid crystal cell
15 -- Liquid crystal layer
16 17 -- Absorption polarizing plate
16a, 17a -- Transparency shaft
20, 20a, 20b, 20c -- Reflective means
21 22 -- Reflective polarizing element (polarization separation component)
21a, 22a -- Transparency shaft
21b, 22b -- Reflective shaft

23 -- lambda / 2 phase-contrast plate
23a -- Lagging axis
24 -- Surface light source
25 -- Light guide plate
26 -- Light emitting device
27 -- Light guide plate which consists of a phase contrast plate
27a -- Lagging axis
28 -- Reflective polarizing element (polarization separation component)
29 -- Circular polarization of light detached core
30 31 -- lambda / 4 phase-contrast plate
32 33 -- Polarization separation component
34 -- Circular polarization of light detached core
35 -- lambda / 4 phase-contrast plate
35a -- Lagging axis

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The decomposition perspective view of the display in which the 1st example of this invention is shown.
[Drawing 2] The mimetic diagram showing the transparency path of the incident light when making one field of the display of the 1st example into the screen.
[Drawing 3] The mimetic diagram showing the transparency path of the incident light when making the field of another side of the display of the 1st example into the screen.
[Drawing 4] The perspective view showing an example of the electronic equipment which had a display in both sides.
[Drawing 5] The decomposition perspective view of the display in which the 2nd example of this invention is shown.
[Drawing 6] The mimetic diagram showing the transparency path of the incident light when making one field of the display of the 2nd example into the screen.
[Drawing 7] The mimetic diagram showing the transparency path of the incident light when making the field of another side of the display of the 2nd example into the screen.
[Drawing 8] The decomposition perspective view of the display in which the 3rd example of this invention is shown.
[Drawing 9] The decomposition side elevation of other polarization separation components.
[Drawing 10] The decomposition perspective view of the display in which the 4th example of this

invention is shown.

[Drawing 11] The mimetic diagram showing the transparency path of the incident light when making one field of the display of the 4th example into the screen.

[Drawing 12] The mimetic diagram showing the transparency path of the incident light when making the field of another side of the display of the 4th example into the screen.

[Description of Notations]

10A, 10B -- Liquid crystal display component
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34 -- Circular polarization of light detached core
35 -- lambda / 4 phase-contrast plate
35a -- Lagging axis

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